Network of Ideas: A Comparison of Cognitive and Sociomaterial Approaches to

Creativity

Isa Borst

s4297466

Department of Psychology, University of Groningen

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Supervisor: Haris Psaros-Andriopoulos

Second evaluator: Dr. Miguel Garcia Pimenta

In collaboration with: Kjell Dantzer, Daniel Eshuis, Luke Hackenberg, and Romano Liu.

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Abstract

Creativity is considered to be an important life skill for adulthood. This thesis compares the dominant cognitive approach and the emerging sociomaterial approaches in the field of creativity and learning. The cognitive approach theorizes primarily from an individual perspective and focuses on the cognitive processes behind creativity and learning. The environment serves as a means to obtain input but is not considered to have an active influence on these cognitive processes. Sociomaterial approaches view creativity and learning as existing within a network. Within this network, the individual, the social aspect, and the limits of materiality appear equally important. Interactions and materials are viewed to be active participators in the creative process. Contrasts between these two approaches raise the question of whether creativity can be developed through education. Future directions could aim at further studying the effects materiality and the social component have regarding learning. Implications of this comparison could require the incorporation of aspects of both approaches into research and policies to consider how the educational field is organized.

Keywords: creativity, learning, cognitive psychology, sociomateriality, agency

Network of Ideas: A Comparison of Cognitive and Sociomaterial Approaches to Creativity

There has been a lot of research in recent years on the concept of creativity. It seems natural human curiosity to want to know where creativity comes from and how ideas come into being. Creativity appears to be abstract, making it difficult to form a concrete and concise definition of it. Historically, it has been assumed that creativity is a trait solely possessed by 'geniuses' or people who have been successful. More recently, the focus when discussing creativity and its definition is moving from being exclusive to 'geniuses' towards the creation of something that was not there before (Rubenstein et al., 2018). This could encompass someone's life work or be a material artifact designed to tackle a specific problem. Researchers largely agree on a definition of creativity that entails the concepts of originality or novelty, and usefulness (Mégalakaki et al., 2018). However, it is crucial to understand that the field of psychology examines creativity from a multitude of different angles and perspectives.

In line with the distinction between the historical and modern definitions of creativity, it has been proposed that the concept of creativity be split. Creativity is no longer deemed as reserved for 'geniuses' and seems present in everyday life. It becomes increasingly important to acknowledge that everyday creativity might not impact an entire civilization but should still be recognized. This is where the distinction was proposed between Big C creativity and Little C creativity (Gabora, 2013; Simonton, 2012). Big C creativity is regarded in the historical context. It refers to ideas and innovations entirely new for humanity, or creators that became famous for their inventions. Little C creativity refers more to the everyday type of creativity. This could entail that something may have been entirely original to the creator at the time but is not regarded as new by society.

Recalling that creativity is defined as producing something novel and useful, historically it has been an important skill for the survival of humans. Therefore, it seems that creativity is an essential part of learning. Our planet and surroundings are constantly changing, and having the skill and capacity to apply knowledge and put pieces together in a new way is essential in finding our way in ever-changing circumstances (Glăveanu et al., 2020). Considering this evolutionary benefit, it seems essential that creativity can be developed to enhance this benefit. Thus, the question arises: Can creativity be learned? Subsequently, are our schools advancing children's creative skills or hindering them? Studies show that the way we approach learning in schools can have an influence on the development of children's creative skills (Rubenstein et al., 2018; Yeh & Ting, 2023). In the article by Yeh and Ting (2023), the implementation of certain programs designed to foster creative thinking in students appears to have a positive effect on creativity development. These findings demonstrate that creativity can be learned and promoted. Promoting creativity is beneficial to learning in general, as it allows students to use the knowledge they learned in new ways. This new use of information leads to increased learning and problem-solving. Stimulating this way of learning and incorporating creativity can prepare students and children for real life.

In this thesis, I will focus on a recent and influential perspective on learning and creativity, namely, the sociomaterial approaches. Delving into these new approaches, this thesis will contrast and compare the sociomaterial approaches with the dominant perspective in the field of creativity, that is, the cognitive approach. This comparison is necessary as the two approaches seem to differ significantly in their basic ontological assumptions as well as their methodological procedures. Cognitive psychology puts emphasis on the capacity people have for creativity on an individual level, whereas the sociomaterial approaches focus on the network of people and materials that contribute to the creative process together. According to the sociomaterial approaches, the network includes not only individual humans but also social

aspects and non-human objects or materiality. Therefore, this research aims to critically reflect on the main theoretical assumptions and methodologies of both sociomaterial approaches and the cognitive approach in the field of creativity and learning. Before this comparison, however, it is necessary to give a general introduction to both approaches.

General introduction to cognitive and sociomaterial approaches

The cognitive approach is an established field within psychology. Originating as a response to the behaviouristic approach, cognitive psychology explains human behaviour through mental processes (Sampson, 1981). Concepts like attention, memory, information processing and perception are at the basis of the cognitive approach. Cognitive psychology has been one of the dominant approaches in explaining various concepts of psychology. It is based on the general assumption that our mind operates similarly to a computer (Vosniadou, 1996), where each individual is conceptualized as an information processing machine. More specifically, it is assumed that people receive input from the objective outside world, which is processed in their minds through various cognitive mechanisms. This proceeds to create behaviour, thoughts and feelings, understood as the output.

After 1975, research into learning developed more prominently in cognitive psychology and shifted the debate on how creativity arises (Shuell, 1986). The cognitive approach to learning is focused on the mental processes associated with learning and can be categorized as individualistic. The environment serves as the way in which input is obtained. However, the environment is seen as entirely separate from the cognitive processes, at least in the case of a purely sense-think-act cycle derived from cognitivism (Ma et al., 2023). Based on this, the conclusion can be made that the cognitive approach sees the environment as being objectively passive and not affecting our information processing directly. However, it is crucial to realize that this involves an extreme side of the cognitive approach. Similarly to the sociomaterial approaches, the cognitive approach is assumed to be heterogeneous and

contains various nuanced arguments. According to the cognitive approach, the way we learn is generally influenced by our individual capacities for certain cognitive processes, expertise, and motivation (Mégalakaki et al., 2018).

On the other hand, sociomaterial approaches focus on explaining learning from a different perspective. Finding their origins and influences in different theoretical paradigms like complexity theory and the actor-network theory, sociomaterial approaches are concerned with entire networks of entities, human and nonhuman (Decuypère & Simons, 2016; Fenwick, 2015). They are not just concerned with humans as individuals, their behaviour and information processing. On the contrary, from the perspective of these theories, it is impossible and perhaps even immoral to split humans from the materiality of non-human objects. Materials and non-human objects are not merely 'just there' but have an active influence on our surroundings and, in that way, influence us as humans (Duff & Sumartojo, 2017). Seeing the world as interconnected makes it essential to study the ways that materials influence humans. Materials are dynamic and designed so that certain actions are possible or promoted while other actions get prevented. They hold values that have been put onto them through their design, creating limitations (Rudnicki, 2021; Tanggaard, 2013). Some scholars of sociomaterial approaches believe that to imply that there are interactions between humans and materiality progresses with the assumption that humans and materiality are separate. According to these scholars, it is more appropriate to define humans and materiality as being entangled within the network and actively constituting each other (Fenwick, 2015; Stierand et al., 2017).

As of recent, more research into learning relies on the assumption that materials are active participators within a network. The sociomaterial approaches deem this assumption fundamental when focusing on learning and creativity. According to sociomaterial scholars, research into learning should consistently consider the active role of materiality. Examples of

this materiality include but are not limited to the interior of the classroom, materials given to the students, or how the teacher chooses to convey information to the students. All parts of this network are regarded equally and should receive equal focus within research. From a sociomaterial perspective, it is counterproductive to research learning by separating humans from the rest of the network (Decuypère & Simons, 2016).

In summary, the cognitive and sociomaterial approaches stem from significantly different backgrounds and influences. Cognitive psychology suggests that human behaviour and learning should be explained through the lens of mental processes. Individual human capacities and cognition are at the forefront of research. On the contrary, the sociomaterial approaches try to understand learning in the context of entire networks. Within these networks, both the human aspect and the material or non-human aspects play roles of equal importance.

Approaching creativity

As this thesis focuses mainly on comparing the recent sociomaterial approaches with the more dominant cognitive approach in the field of creativity, it seems crucial to lay out the way that creativity is approached. The following sections will focus on some of the fundamental ontological assumptions the two approaches hold regarding learning. On this basis, both approaches will be compared. Firstly, a comparison is drawn based on the arguments the two approaches make on what actively contributes to the creative process. Secondly, the standpoints of both approaches are laid out concerning the roles that materiality and non-human objects play in the creative process. Thirdly, the two approaches are contrasted on the ontological assumption of whether creativity is considered to be an intellectual trait or an embodied process. Additionally, these ontological differences between the two approaches imply that there are dissimilar procedures regarding methodology within research.

The discussion of this thesis examines agency and the differences in ascribing agency according to both approaches. Consequently, the relevance of this comparison between the two approaches is discussed, along with the implications this comparison may have for the educational field.

<div align="center">**Analysis**</div>

The individual vs. the network

When comparing the cognitive approach to the sociomaterial approaches, there is an apparent contrast in the perspective from which the creative process is considered. Cognitive psychology concentrates on individual differences in abilities. Creativity is assumed to be an inherently human ability with individual differences in capacity (Mégalakaki et al., 2018). Cognitive research on creativity usually reverts to problem-solving, specifically solving ill-defined problems that need restructuring to arrive at solutions (DeYoung et al., 2008). The mental processes of the individual that play a role in problem-solving lead to the creation of something novel and useful. A widespread model to illustrate this would be the four-stage model of the creative process (Lubart, 2001). This model explains the four stages of creativity: preparation, incubation, illumination and verification. Preparation is regarded as 'conscious work' on the process or idea; the problem is discovered here. Incubation is the stage that is entered into afterward and is explained as the 'unconscious work'. While there is no conscious effort being put in, the individual's mind is constantly working on the problem in the back of the mind. The illumination stage is where the solution just seems to come to mind. Lastly, the verification stage explores and defines the idea that appeared in the illumination stage. What is striking about the model is that every stage in the process is described from a purely individual standpoint. In a critical analysis of the cognitive approach by Sampson (1981), it is argued that cognitive scholars lean on the assumption that individual mental processes and ideas are more important than anything from the objective environment.

Cognitive psychology hypothesizes a separation between internal representation and the environment. The environment gains meaning entirely through human thinking (Sampson, 1981). This separation can be defined as representational thinking.

Contrastingly, in sociomaterial approaches, scholars are convinced that it is clear that not only the human individual is important in the creative process. Creativity is considered to encompass both human and non-human entities. Non-human entities specifically refer to both social aspects of the environment and materiality. Sociomaterial scholars view creativity as a process in which humans and non-human objects contribute together (Duff & Sumartojo, 2017). Focusing on the social aspect of creativity, humans are constantly in contact with each other, altering the creative process. For example, whenever an individual or group produces an idea, this idea is commonly communicated in some way. When an idea is communicated or worked on, it is constantly changed. This, according to sociomaterial researchers, confirms that the social dimension of our species and society does have an active influence on how ideas come into being. The social aspect is crucial in creativity to explore through available options and materials (Rudnicki, 2021).

An example where the social aspect is equally important for the creative process is provided in an experiment by Kim and Zimmerman (2019). In this experiment, children and their families engaged in a workshop, encouraging them to be as creative as possible. The goal was to produce inventions and solutions in two design challenges. The creative solutions seemed to emerge when children engaged in interactions with the resources that were available. The materials allow the children to play around and see what is possible. The social component included the family members being present and working together on the inventions, enabling the children to be guided in their ideas and build on those ideas (Kim & Zimmerman, 2019). This provides an example of how the social aspect could be considered an active participant in shaping ideas and final results. Sociomaterial scholars conclude that

learning and creativity cannot be adequately researched if the focus is purely on individuals (Fenwick, 2015).

At this point, it should be pointed out that the cognitive approach does acknowledge creativity to be able to take place between people. However, the assumption is that individuals need similar thinking or shared frames of reference to creatively collaborate on ideas (Stierand et al., 2017). This means that ideas can only be worked on together if both minds share the same view on developing the idea. Sociomaterial approaches, in contrast, consider the social aspect as actively participating in the creative process. This social aspect is crucial for the process and can take different forms. The requirement of similar mental processes for collaboration to take place is not necessary from this standpoint (Stierand et al., 2017).

In this regard, based on the number of people argued to be included in the creative process, the cognitive approach and sociomaterial approaches are suggested to be dissimilar. The cognitive approach focuses on the individual, whereas the sociomaterial approaches focus on the individual as much as the social aspect and interaction. Additionally, materiality accounts for contrast between the viewpoints of both approaches.

Role of materiality in creativity

This contrast is explained by the role both approaches ascribe to materiality. Sociomaterial approaches focus on integrating the material aspect of learning and creativity in research. Materiality is considered to influence learning and creativity, limiting certain possibilities while promoting others. When objects are being designed, humans put certain social norms and values into them, which causes material limitations by enabling specific actions when using the material and inhibiting other actions (Rudnicki, 2021). In this way, the material resources actively shape the creative process through the way they can be used (Tanggaard, 2013). Students will learn differently using a pen and paper than with digital games designed to promote learning. In sociomaterial approaches, creativity is grounded in

materiality (Fenwick, 2015). From a sociomaterial perspective, ideas cannot be excluded from the process of finding that idea. Materials play an active role in this process while simultaneously being rooted in social norms. Materials used in finding or exploring an idea change both learning and creativity. For example, modern whiteboards in classrooms are mostly interactive nowadays, enabling teachers to use presentations and pictures to emphasize their points. This creates a different teaching method from the chalkboard that needed everything written out, influencing learning. This applies to all materials. These limitations or possibilities, in turn, influence the creative process of exploring an idea. How an idea is changed, worked on, or communicated can be approached in varying ways, depending on the available materials (Rudnicki, 2021). From a sociomaterial perspective, this contact with and possible resistance of materials participating in the network causes new ideas to arise (Tanggaard, 2013).

Regarding the cognitive approach, the general assumption is that the environment merely provides input for individual minds to work with. This input from the environment is not considered to influence the information process directly (Ma et al., 2023). As a result, it is possible for cognitive psychology to study these individual processes that play a role in the creative process independent from the rest of the objective world (Ma et al., 2023). Fundamental to the cognitive approach is the sense-think-act cycle that explains how the mind processes the input from the environment. Thinking is the core part of this model, whereas the environment is regarded as passive (Ma et al., 2023).

An argument can be made that the cognitive approach could potentially agree with the assumption that materials play a role in the creative process. However, this would presumably entail that materials are tools but have physical limitations. However, from the research, it seems that these limitations do not actively influence the progression toward individual goals and are not deemed actively participating. Sociomaterial approaches expand on this

assumption and integrate materiality as an active participant in the network. Consequently, materials are not 'just there' but actively shape the process and the product that results from it. Materiality is a mediator in the network of the creative process. The whole network is complex and deeply interconnected (Fenwick, 2015). Here, the concept of agency needs to be discussed. Cognitive psychology ascribes agency only to humans and some non-human animals based on the sense-think-act cycle (Ma et al., 2023). Materials are not considered to have cognitive processes and are, therefore, not ascribed agency. Since the environment is solely how input is obtained, materials do not actively influence the creative process. On the contrary, sociomaterial scholars do believe materiality to possess a form of agency. As stated previously, materials influence the creative process, and in that way, they 'act'. Both the material and the human aspects continuously interact and change the process, and in that way, they are ascribed agency. In the sociomaterial approach, agency is ascribed to the process and is constantly present and changing in all aspects of the network (Hultin, 2019). An example of materiality's role might be the way a classroom is set up. Having tables grouped together might be beneficial for doing group projects within the class and brainstorming ideas, but it might facilitate distractions when doing individual activities. The same would apply vice versa. Thus, the materiality within the classroom will actively influence the way the students interact with each other and learn.

In short, within the cognitive approach, it is apparent that the individual is the autonomous agent in the cognitive process. Sociomaterial approaches, on the other hand, ascribe this agency to more than the individual. Agency is located in both the social and material aspects of the network and is interconnected in the creative process. This viewpoint of the sociomaterial approaches suggests a more embodied view of creativity.

Intellectual and embodied creativity

Building on this perspective, it is apparent that the cognitive approach focuses on the intellectual dimension of creativity, whereas sociomaterial approaches advocate for an embodied dimension of creativity. From the cognitive perspective, learning and creativity are approached in relation to thinking, information processing and problem-solving (Mégalakaki et al., 2018). Specifically, as has already been mentioned, when focusing on problem-solving, creativity is considered to play a role in solving ill-defined problems. Ill-defined problems are defined as problems that depend upon insight to reach a solution. Mental processes that are thought to influence insight are convergent thinking, divergent thinking and the ability to break frame (DeYoung et al., 2008). Convergent thinking is associated with standard intelligence, and is necessary to notice that the known knowledge is insufficient to solve the current problem. Divergent thinking plays a role in pattern recognition, which is needed to restructure the problem and its elements. Lastly, the ability to break frame is needed to prevent the individual from remaining stuck on the already known solutions. This ability plays a crucial role in determining when it is necessary to restructure a problem using the creative process. Given that convergent thinking or standard intelligence is a key contributor to solving insight problems, a generalization might be made that more intelligent individuals will also be more insightful, leading them to be more creative (DeYoung et al., 2008). From this perspective, more creative individuals seem to identify irrelevant stimuli more rapidly, which makes thinking "out of the box" accessible (Simonton, 2012).

Assuming that intelligence and individual capacities for mental processes determine the ability for creativity, the question arises whether creativity can be developed. Research done by Rubenstein et al. (2018) questioned 525 teachers on their perception of creativity development and raised the question of whether it can be taught. Interestingly, when asked to define creativity, 94% of the sample of teachers completely omitted the environment. The focus of these teachers was primarily on individual behaviours contributing to creativity

development. Contrarily, when asked what interferes with creativity development, teachers mentioned compulsory curriculum and limited time to focus on creativity. Some researchers agree that creativity development seems to drop when academic pressure on performance is high (Yeh & Ting, 2023). This implies that creativity can be developed and that the environment is a factor.

Sociomaterial approaches explain creativity in a more embodied way. Embodied refers to the assumption that all concepts involve interactions between the individual, the social and the material aspects of a network (Tanggaard, 2013). Embodied creativity can also be observed as flow, meaning interaction between social and material aspects constantly changes and facilitates the process (Duff & Sumartojo, 2017). Historically, a considerable amount of research has been done on representational thinking. Representational thinking separates human individuals from the 'natural world'. The natural world in this perspective is entirely objective and factual, whereas the individual perception of this 'natural world' is subjective and varied. Every individual has a different outlook on the natural world through the lens of their cognitive processes and experiences. Sociomaterial approaches propose an alternative way of thinking: relational thinking. Relational thinking entails that both the human and non-human aspects of a given setting are considered simultaneously. These aspects continuously interact with each other to make up creative processes, actively influencing the setting to be embodied. All 'actors', human and non-human subjects, are of equal value in this network (Decuypère & Simons, 2016). The difference between this framework and a more individual understanding of creativity is that the individual perspective negates the influence the environment can have on cognitive processes. The assumption is that creativity is reserved for the intellect. However, networks and humans are constantly improvising in day-to-day life, adapting to their surroundings and considering all aspects of the network. In doing so, humans are being creative. This improvising and interacting with the social and material makes

creativity more of a continuous, everyday, embodied process (Tanggaard, 2013). An example concerning learning and creativity could be if a teacher notices that students are not engaging with the material, the teacher could decide to figure out an alternative way to convey the information to them on the spot. This creative improvising is part of this network within the classroom and is actively shaping learning.

In summary, ontological differences between the cognitive approach and sociomaterial approaches include the number of people that are considered part of the creative process, the role materiality is ascribed within the process, and the nature of the creative process itself. Additionally, the indicated ontological differences reasonably imply that there are methodological differences as well.

Questions of methodology

The ontological differences between the cognitive approach and the sociomaterial approaches are fundamentally about how creativity is viewed. However, the perspective on creativity and how it manifests itself also impacts the research methodology.

In general, the cognitive approach studies creativity through the lens of the individual. The general assumption regarding the human mind is that it operates like a computer. This implies that creativity is an individualistic trait solely based on cognitive processes. Research from the cognitive approach, generally testing theories and assumptions, is mainly done using experiments and case studies (Lubart, 2001). Characteristic of experiments is the ability to control for variables that are not relevant to the subject of research. In order to control the variables in a reliable and structural manner, the preferred environments for these experiments are laboratories or other controllable environments (Ma et al., 2023). When questionnaires are used, controlling for variables is the goal as well, but it can be challenging. Conditions are often not universal when questionnaires are implemented. Therefore, a set grading system is developed to minimize the bias and error of the researcher assessing the measurement.

These experiments and questionnaires are the chosen form of research from the cognitive perspective because the assumption is that creativity only exists from these cognitive processes. Accordingly, researching these processes would give sufficient information on how creativity is achieved. Since the environment is not considered to influence the creative process directly, controlling for environmental variables does not impact the research.

As for the sociomaterial approaches, scholars argue that the network should be viewed as a whole. The individual plays a significant role but not the only role in this network. From this angle, it is less critical to be able to control variables in the environment. Considering those variables from the environment, they must be studied simultaneously. Those factors from the environment that actively participate in the network need the same amount of attention as the individual aspect. The difference in the definition of creativity calls for alternate ways of conducting research. The development of research methods that use relational thinking has been recent. It calls for the environment to be considered as well, usually by direct observation of what happens in a given setting. However, through this observation, the researcher becomes part of the network of that setting, which entails that not only the social interactions and the material resources have an effect, but also the research of the silent observer influences the situation (Hultin, 2019). To incorporate the role of the researcher in this way is relatively contemporary. Continuing from this notion, the materials used to conduct such research are active participants in the same way as the materials in the classroom are. Taking all of this into account, sociomaterial research cannot be separated from itself and the environment, making it challenging to create generalizing theories. Sociomaterial research is rooted in direct observation and therefore rejects generalizing theories as such generalizations cannot occur in their opinion. The aim is to make arguments solely by considering the phenomenon that is directly observed (Hultin, 2019). Following this

practice, sociomaterial approaches seem to focus on the more 'natural' aspects of research by using direct observations as the basis for any arguments that are presented. This methodology allows for the observation of all the participating actors within the network in order to get a complete understanding (Decuypère & Simons, 2016).

Tanggaard (2015) provides an example of such research, focusing on creativity in everyday life. The article describes in great detail how the researcher took a train ride. The creativity observed consisted of people constantly adapting to each other and improvising to respond to the situation's movements, arguing that creativity is constantly present. This research was done purely by direct observation while aboard a train.

It becomes clear that the underlying ontological assumptions of the two approaches directly influence research practices. The cognitive approach takes an individualistic standpoint to creativity, where creativity is viewed as entirely separate from both the environment and the research, effectively enabling the researcher to study the concept of creativity in isolation. On the other hand, sociomaterial approaches adopt an embodied way of conceptualizing creativity, meaning that the creative process happens through interactions between humans and non-human objects. The research and researchers are no longer separated from the process but instead participate in the network they observe. These ontological fundaments that underlie sociomaterial approaches oppose the making of generalizing statements in a way that the field of science is used to. It seems that how creativity is understood from these different perspectives dictates how creativity is researched. The way researchers choose to research the concept of creativity helps us further understand how they view creativity.

Discussion

It becomes evident that there is a significant difference in both ontological assumptions and methodological fundaments between the cognitive approach and

sociomaterial approaches. Concerning the particular matter of agency, the cognitive approach ascribes agency exclusively to humans and non-human animals. Specifically regarding creativity, agency is the specific choices and ideas a person produces. Materials are categorized as tools that facilitate carrying out the idea, but they are not regarded as active participators in the creative process. Active participants are categorized as first processing information before responding to stimuli, implying that without planning, there are no actions (Ma et al., 2023). Materials are not seen as being able to plan or have higher cognitive processes and consequently do not get agency ascribed to them.

From a sociomaterial perspective, agency is distributed and does not exclusively belong to humans. As stated before, from this perspective, the interactions and materiality also possess agency. In the case of materiality, it enables and inhibits actions that can be performed. Rather than being passive, non-human objects within the network are dynamic and considered to be mediators of the creative process. Agency does not belong to a single aspect of the network but is instead a characteristic of the flow of actions (Hultin, 2019). According to sociomaterial scholars, classroom materiality must be considered when it comes to learning and creativity. Strengthening the learning material by utilizing presentations or images can help certain students gain better oversight of the material.

When material agency is considered, an implication of this more embodied process of learning and creativity is that research can be done on how to best approach the material design of classrooms. Results from these studies can provide new guidelines for policymakers in the educational field. When learning goals and curricula are created, considering the active influence of materiality, a classroom can be arranged in a way that is most beneficial to the learning goals and the development of creativity. This goes for materials used in the classroom as well. Research must be done into beneficial materials to provide to students that enhance learning and creativity, to determine which materials are most effective.

Comparing the cognitive and sociomaterial approaches demonstrated interesting differences in knowledge about how the educational field is set up. Cognitive psychology has long been the dominant approach in many fields of psychology. Sociomaterial approaches, on the other hand, are more recent, having emerged in the last two decades, but provide a drastically different outlook on the concepts of learning and creativity. The focus of the thesis aimed to showcase the sociomaterial approaches to the concept of creativity and contrast them with one of the dominant approaches in the educational field. Incorporating additional aspects than the individual when considering the creative process appears significant. Nonetheless, sociomaterial scholars might overestimate when talking about material agency and network heterogeneity. Within this thesis, it is believed that it is important to stray from the notion that learning is done purely individually. It has been proven that learning and creativity are concepts that rely on social interactions in addition to being influenced by the constraints of material resources. Going against the cognitive perspective, it does not seem that these concepts can be completely isolated and negated from the environment as an influence. On the other hand, I believe influences and agency from the material aspect are not entirely of the same importance as the individual processes or the social aspect of learning. Materiality does influence the creative process. However, physical limitations of materials can be overcome, as has been done many times throughout history. For future research and its implications in the educational field, I believe it would be beneficial to incorporate aspects of both approaches.

The implications for the educational system should be primarily focused on awareness of the influence of participating aspects in the network of learning. It seems logical to argue that materials have limits that influence their use. Furthermore, how teachers perceive creativity impacts creativity development. Creativity might not be regarded as teachable when the assumptions are centred on individual capacities (Rubenstein et al., 2018).

Subsequently, it seems that the method by which teachers convey the subject matter to students also influences learning. From the comparison between the cognitive approach and sociomaterial approaches in this thesis, it seems that research could potentially concentrate on studying the influences the social aspect has on learning and creativity. These social interactions can be studied further to determine an approach to teaching that policymakers can implement to support students further. To come to such an approach, more research would need to be done using direct observation to determine which way of conveying information enhances learning and creativity best.

The cognitive and sociomaterial approaches seem to agree that creativity is an important skill to develop for adult life. Life outside of academia is mainly comprised of adapting to ever-changing surroundings and solving problems that require insight. As sociomaterial research has claimed, it is essential for the educational field to be aware of how we teach students and what materials are provided, as it does seem to change how learning takes place fundamentally.

It is equally crucial to mention that this thesis has focused on a limited body of research. That body of research also aimed to be on the more extreme sides of both approaches to compare them adequately. That being said, both approaches can be categorized as heterogeneous, meaning that within them, they contain many different opinions and nuances about the research topic. It is impossible to do both approaches justice in the selective way it has been done in this thesis.

Conclusion

In summary, this thesis focused on comparing the emerging sociomaterial approaches with the dominant cognitive approach, in the field of learning and creativity. The research shows that the cognitive approach focuses exclusively on the individual creative person. The environment might be recognized as a tool but in itself does not influence the creative

thinking process of the individual. Learning and creativity are studied based on individual mental processes that underlie these processes. Comparingly, sociomaterial approaches focus on the creative process, viewing it as a network where the individual, the social and the materiality are equally important. Creativity is assumed to be an embodied process that occurs constantly in everyday life. Materiality and interactions actively dictate how students learn and how creativity is developed.

As stated in the discussion, the research this thesis is based on is limited. Both the cognitive approach and the sociomaterial approaches are deemed to be heterogeneous and nuanced in their assumptions. Adopting the more extreme view of either approach made the comparisons between the approaches more straightforward but also causes limitations of the arguments made within the paper. It is unattainable to do both approaches full justice in this comparison based on limited research.

For future research, it is essential to delve further into the historical background of the two approaches. Specifically for the educational field, both approaches have merit. The cognitive approach has long been dominant and well-accepted in the field of education, and disregarding focus on the individual and cognitive capacities would be unwise. However, I believe that for future research, it can be beneficial to consider components of the sociomaterial approach. The materials we use in both research and the educational field have their limitations and influence the learning process, whether it is an active or passive influence. It is crucial that researchers are aware of this influence when they design studies. Additionally, this also applies to policymakers in the educational field, as well as teachers. How teaching is conducted has an observable influence on students' learning, both in how the information is conveyed and the materials provided within the classroom. Awareness of these influences will likely play an essential role in how education is organized in the future.

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