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**Creativity mindset, creativity and informing about the nature of creativity as a tool  
to increase growth creativity mindset**

Research paper

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**Abstract**

People differ in how they perceive creativity: some see it as a fortuitous talent which one either possesses or not since birth (so-called fixed creativity mindset), others as a malleable ability possible to be developed by everyone (so-called growth creativity mindset). The current paper addresses the question whether raising awareness of the essence of creativity can increase one's belief in their capacity to improve their creative ability, i.e., increase one's growth creativity mindset. Theoretical part overviews the creativity-related literature to summarize the essence of creativity and discusses its malleability. In the empirical part, a sample of high-school students (N = 48) were presented with a lecture on the topic of creativity to test its effect on their creativity mindset. Participants' creativity was assessed using the K-DOCS scale (measured once) and creativity mindset using the KCM scale (measured twice). The findings suggest that informing about the malleable nature of creativity and the specifics of the creative process is beneficial for the participants' growth creativity mindset. Additional relations between creativity and creativity mindset are explored and discussed as well.

**Keywords:** creativity, mindset, creativity mindset, stereotypes, implicit beliefs

## **Loovust puudutav mõttelaad, loovus ning loovuse olemusest informeerimine kui arengule suunatud mõttelaadi soodustamisviis**

### **Kokkuvõte**

Inimesed mõistavad loovust erinevalt: mõned näevad seda juhusliku andekusena, mida inimesel kas on või mitte (kinnistatud loovust puudutav mõttelaad), teised aga paindliku oskusena, mida igaüks saab arendada (arengule suunatud mõttelaad). Käesolev töö keskendub küsimusele, kas loovuse olemusest informeerimine soodustab inimese usku tema võimekusse arendada tema loomevõimet, st soodustab tema arengule suunatud mõttelaadi. Teoreetilises osas on võetud kokku loovuse teemalise kirjanduse alusel loovuse olemus ning on arutatud loomevõime paindlikkuse üle. Uurimuse empiirilises osas peeti gümnaasiumiõpilastele (N = 48) loeng loovuse olemusest, et uurida selle mõju nende loovust puudutavale mõttelaadile. Osalejate loovust mõõdeti K-DOCS küsimustiku abil (mõõdetud üks kord) ning osalejate mõttelaadi mõõdeti KCM küsimustiku abil (mõõdetud kaks korda). Tulemuste põhjal saab öelda, et loovuse olemusest ja loova protsessi eripärast informeerimine on arengule suunatud mõttelaadi soodustav. Lisaks uuriti ka loovuse ja loovust puudutava mõttelaadi vahelisi seoseid ja arutati nende üle.

**Märksõnad:** loovus, kreaatiivsus, mõttelaad, arengule suunatud mõttelaad

## Introduction

“A student was asked to determine the height of a tall building with the aid of a barometer. The answer the student provided was to attach a long rope to the barometer, lower it from the top of the building to the street, and then bring it up and measure the length of the rope. This was not the expected answer, however. The examiner gave the student another opportunity to answer, warning him that the answer should show some *actual knowledge* of physics. The student came up with several possible answers yet settled on dropping the barometer from the top of the building and timing its fall. The examiner agreed that this satisfied the requirement but asked the student what the other answers were. The student proposed a few more physics-related solutions possible; however, he chose as the best one to knock on the superintendent’s door and speak to him as follows: “Mr. Superintendent, here I have a fine barometer, and if you tell me the height of the building, it will be yours.” The student later admitted that he knew the conventional answer (which uses the barometer readings) but was fed up with the professors’ teaching him how he *has to* think rather than teaching him the *structure of the subject*.”

This well-known story was first written by a physicist Alexander Calandra (1959); Robert Allen (2004) provides this story as a vivid example of *creativity*: it is doubtful whether the student’s protest was at the right time, but he clearly demonstrated his ability to think creatively.

We are living in the age of creativity. Creativity is considered important for social transformation and economic growth (Howard et al., 2008). Creativity is already a common job requirement and is proposed to become even more important up to 2030 (Easton & Djumalieva, 2018). According to Daniel Pink (2006), after the information era we are currently living in, which values knowledge, comes the conceptual age era, which values the ability to create. Being a creative person becomes a necessity.

Despite its importance, creativity has been largely mystified throughout history. Insight, or “Aha”-experience of spontaneous realization, has been widely romanticized (Kerr, 2009). A common belief declares that creative abilities, let them be artistic or mathematical, are related to special giftedness and natural proclivity (Kerr, 2009). People keep struggling with the question: “How is it possible to be creative when you’re not?”. Popular culture even suggests a relation between creativity and madness (Kaufman et al., 2006), providing a possible excuse “If I am not creative, at least I am normal”.

A brief perspective on how real-world people define creativity can be provided by answers shared on from the forum-type social network Quora (questioned by Valerio, 2018). Users' definitions of creativity were the following:

- ability to stretch imagination into something worthwhile or that pleases people;
- ability to make something new that is not already designed;
- one's imaginative power being seen as incredible and extraordinary;
- "something" that the brain processes, which is a God given talent;
- generate alternatives and possibilities and solve problems in a different way;
- ability to, when presented with an idea, generate similar ideas;
- performing bold actions, thinking out of the box, living life without thinking about what others think, seeing the world in a different than others way etc.

Common perception of creativity seems similar to the dictionary definition, which is simply "the ability to create" (Merriam-Webster, n.d.), or "the ability to produce or use original and unusual ideas" (Cambridge Dictionary, n.d.), with certain specifications like "imaginative power". However, it remains unclear if the one who considers creativity an imaginative power finds imaginative power learnable—or, as one user did directly put it, "a God-given talent"; this aspect of common perception of creativity seems problematic.

The importance of creativity leads to the following questions:

- a) whether creativity in its essence is a fortuitous talent or an ability possible to develop,
- b) whether people have a realistic perception of the creative process and are aware of the malleability of creativity,
- c) whether raising awareness of the essence of creativity can increase one's belief in their capacity to improve their creative ability.

This study will attempt to respond to these questions.

In the theoretical part of the current paper firstly the question of the essence of creativity and its possible malleability will be discussed, and secondly a topic of mindset theory conceptualization of laypeople's beliefs regarding creativity will be addressed. In the empirical part, creativity and creative mindset tests will be carried out on the sample of high-school students, and the question if raising awareness of the essence of creativity can increase one's belief in their capacity to improve their creative ability, will be tested.

## **I part. Creativity**

### ***Creativity definition***

The word “creativity” can be used in different ways: it might refer to the trait that the authors of the works acknowledged as creative possess; to the potential to produce creative works; to everyday quick-witted behaviors; to specific activities like art and music, etc. (Hayes, 1989). Systematic study of creativity started with Joy Paul Guilford (1950), who described creative behavior as including “such activities as inventing, designing, contriving, composing, and planning”. However, since then there is still no universal definition and defining the term is considered problematic (Cropley, 2000; 2006; Sternberg, 1999; Zeng et al., 2011). Creativity is usually treated in terms of Rhodes’ (1961) 4-P model as a dynamic phenomenon comprised of four interactive components, which are person (people), process, product, and press (Zeng et al., 2011).

The simplest definition states that creativity is the ability to produce something that is both novel and appropriate (Sternberg & Lubart, 1999). More abstract definitions describe creativity as a moderating variable for the transition of intellectual potential into outstanding performance (Renzulli, 1986), or a change in one’s perspective that leads to insights, inventions, and enlightenments (Cronin & Loewenstein, 2018). Creativity can be defined as the capacity to generate novel, socially valued products and ideas (Mumford et al., 1994), or as a process that results in an artifact judged as original and useful—solution, thought, product, etc. (Horn & Salvendy, 2006). Based on a comprehensive review of over 50 years of research, Sternberg (1999) summarized the variety of creativity definitions as “creativity involves the creation of new and useful products including ideas as well as concrete objects” (Sternberg, 1999, p. 450).

The standard definition has not avoided being questioned. Novelty is definitely necessary since something ordinary, routine, or conventional is under no condition creative; the aspect of value is controversial (Pichot et al., 2022). Amabile (1983) proposed that any cognitive process must also be judged on its fruit, and the distinguishing sign of creativity is its outcome product. Creative realism suggests that a creative product should not only be original but must also effectively tackle real-world issues, and a product that is novel, but odd, bizarre, and serves no purpose should not be considered creative (Finke, 1995). However, this leads to a conflict between researchers’ definition and commonplace definition reflected by dictionaries, which relate creativity to novelty only considering value not so essential (Weisberg, 2015). Studies even suggest that novelty and value tend to be negatively correlated (Pichot et al., 2021).

An example of something new, but completely useless has been provided by Pichot et al. (2022): a paranoid schizophrenic person who believes that aliens can read his thoughts constructs a helmet to prevent this. From a standard perspective, this product, although possibly novel, is of no value, as “there probably are no aliens trying to read his thoughts” (Pichot et al., 2022, p. 9). The lack of value, however, comes from working under incorrect premises: if considered that for the creator these premises are true, it makes the creation of the product legitimate in given conditions, and thus, creative.

Weisberg (2015) makes the point that the value of the creative product does not remain stable over time and place: many recognized creative people—like Galilei, Van Gogh, or Kafka—had received no appreciation during their lifetime, so back then their works had been considered of no value; however, the acknowledgment of the value of their products did come to them after their death, which can lead to the problematic conclusion that they “became” creative posthumously (Weisberg, 2015). Thus, Weisberg (2006, 2015), defined creativity as “the goal-oriented production of novelty” (Weisberg, 2006, p. 761), letting aside the value.

Cropley (1997, 2000, 2006) proposed to distinguish real creativity from quasicreativity, which takes place when the created novel product is not adapted to the real world. According to Cropley (2006), although quasicreativity has much in common with “genuine” creativity (e.g., high level of fantasy), it differs from it as it has only a tenuous connection with objective reality, and does not perform its role as intended, thus lacking practical value.

Summing up, novelty and appropriateness are the key to defining creativity (Zeng et al., 2011), and these two criteria can be taken as an acceptable simplification. However, it tells little about the essence of the phenomenon if taken out of context.

### ***Problem-solving approach to creativity***

At its simplest, creativity is the ability to create something new and valuable. Conceptualizing creativity, however, requires answering the question: what do people need such an ability for?

The idea of creativity being a problem-solving skill was originally proposed by Guilford (1956) himself. Robert Weisberg (2006) conceptualized creativity as a complex cognitive ability that allows people to perform problem-solving (i.e., tackle the issues they face). In order to distinguish creative responses from those that are bizarre, he introduced the criterion of intentionality instead of the traditional value criterion: thus, a product is creative if it is both original and matches the intention of the individual, whether that intention is externally acknowledged as valuable or not. (Weisberg, 2006; 2015). Intentionality does

exclude, however, the “word salads” produced by mentally unstable individuals, or the “writings” of monkeys on typewriters (Runco & Jaeger, 2012; Pichot et al., 2022; Weisberg, 2015). As creativity can take different forms—a scientist, an artist, an entrepreneur, the student from the story provided above, are creative in very different ways—the problem-solving approach provides the universal creativity scheme (Weisberg, 2006), which allows to conceptualize creativity in its diversity (as although different, “to express feelings in a poem” or “to resolve an unresolved paradox in physics” are both problems to solve for the individuals who face it).

Problem-solving is the process of articulating solutions to problems. According to the problem-solving theoretical basis (Jonassen, 2000; Jonassen & Hung, 2012), the term “problem” by definition implies the existence of the unknown in the case (the difference between a goal state and a current state). The *problem* can be distinguished from the *task*: to find the solution to the problem is the aim of a problem solver (which requires creativity), while tasks have a known solution and the aim is only to physically go through the steps of completing it, which lacks the creative element (Chang, 2019). Problems fall into well-structured (those that have linear definition; unlike the task, well-structured problem implies the presence of the multiplicity and the unknown), and ill-structured problems (in which case both the path and the goal state are both unknown or open to negotiation); most problems people face in everyday, personal, or professional lives are ill-structured. Solving ill-structured problems requires restructuring to resolve the unknown (Jonassen, 2000; Jonassen & Hung, 2012), which requires creative ability. Problem-solving differs from decision making, as decision making is only a component of the complex problem-solving process (Jonassen, 2000).

Albert Einstein is quoted as suggesting that “the formulation of a problem is often more essential than its solution” (Einstein & Infeld, 1938, p. 83). If no one perceives an unknown or a need to determine an unknown, there is no perceived problem; problem-solving process begins with finding the unknown (Jonassen & Hung, 2012). Problem finding is named to be a crucial component of creativity, which initiates the whole creativity process (Runco & Nemiro, 1994).

Combining Weisberg’s problem-solving creativity approach, problem-solving theory and Cropley’s idea of the necessity of any idea being adapted to reality, creativity occurs when the person is able to find previously unresolved problems, generate original solutions, and choose and perform the most optimal one, which facilitates the achievement of the goal in given real-world conditions (that is, solving the formulated problem).

### ***Divergent and convergent thinking***

The term creativity is inextricably linked to the construct of divergent thinking, which is often opposed to convergent thinking, both first proposed by Guilford (1956) to describe the structure of the creative process. Divergent thinking is defined as the ability to produce as many solutions as possible to an open-ended problem, while convergent thinking as focusing on coming up with one possibly optimal answer (Guilford, 1956, 1967; Cropley, 2006). Divergent thinking is described as spontaneous and free-flowing, where many ideas at a time are generated, while convergent thinking emphasizes logic, and focuses on familiar techniques and stored information (Cropley, 2006). Taking creativity as an ability to produce something that is both novel and appropriate, a simplified model would assume that divergent thinking is responsible for generating novel solutions, and convergent thinking for their evaluation in terms of value.

Since Guilford (1956) first proposed divergent thinking as the measurable aspect of creativity, it has been quickly taken up by further creativity research, leading to the development of multiple divergent thinking creativity tests (Zeng et al., 2011). The most famous divergent thinking task is Guilford's (1956) original Alternative Uses task, in which participants are expected to generate as many uses as possible for everyday objects; the responses are rated based on flexibility, originality, and fluency, providing a total creativity score (Wallach & Kogan, 1965). However, being no more than a first proposal on the topic of possible measurement, the popularity of divergent thinking tests eventually led to the substitution of the terms: once established, tests of divergent thinking became tests of creativity, leading to terms "creativity" and "divergent thinking" being used interchangeably (e.g., Benedek et al., 2014; Olson et al., 2020, Reuter et al., 2005; Wießner et al., 2022). Divergent thinking tests remain to be the most popular creativity measurement tool, e.g., Torrance Test of Creative Thinking (Torrance, 1966), probably due to the fact that they are easily assessed and quantified (e.g., Runco, 1991); however, they are widely criticized for the very principle of testing (e.g., Baer, 2011; Cropley, 2000, 2006; Dietrich & Kanso, 2010; Plucker & Runco, 1998; Zeng et al., 2011).

The criticism of divergent thinking being the embodiment and representative of creativity as a general phenomenon has multiple aspects. Real-world creativity requires not only idea generation, but also ideas' judgment on their appropriateness to given conditions, i.e., convergent thinking, and once generated, ideas' further development and bringing to life (Cropley, 2006; Zeng et al., 2011). Both divergent and convergent processes are involved in

both creative and non-creative thinking, which makes it impossible to isolate the creative component involved in either (Dietrich & Haider, 2014). The actual creative process is a long-term one and consists of multiple stages (Zeng et al., 2011), and the ideas' generation stage is only one of them. Analyzing multiple divergent thinking studies, Mansfield & Busse (1981) concluded that there is no evidence relating divergent thinking test results to actual creative performance.

Divergent and convergent thinking constructs seem problematic not only as it does not cover the whole complexity of the creative process, but the construct itself is artificial: once a reasonable suggestion, it did not find empirical evidence in terms of neuroscience, as both divergent and convergent thinking involve all main cognitive abilities like perception, attention, memory, language, auditory, visual and spatial abilities, and executive functions (Dietrich & Kanso, 2010; Dietrich & Haider, 2014), making it a legit but overly simplified model.

Research on the topic suggests that divergent thinking tests results through relation to some intermediate construct might be used as a tool to estimate a certain potential for creative performance, but taken separately, divergent thinking says little about the implementation of the potential (Runco, 1991).

### ***Stages of the creative process***

The term “creative process” refers to the sequence of cognitive activities that can lead to both novel and appropriate productions in a given context (Lubart, 2001); or, in a problem-solving model frame, the sequence of activities which effectively overcomes the difference between a goal state and a current state in an original, previously nonexistent way. Most creative process models proposed can be summarized as a sequence of four phases: problem analysis, ideation, evaluation, and implementation (Howard et al., 2008; Zeng et al., 2011).

Before creativity became a field of systematic research, Graham Wallas (1926) wrote down the first four-stage model of the creative process consisting of preparation (investigation of the problem), incubation (period during which the problem is not consciously thought about), illumination (appearance of the idea), and verification (testing of the idea), which became foundational in creativity research and has “shown its usefulness through years” (Runco, 2004, p. 665). He based his work on Henri Poincare's idea of unconscious exploration of the idea before getting the outcome, accentuating that the illumination (also *insight*) stage is not a ready-made one, but the result of the incubation stage, which is initiated by the conscious

investigation in the preparation stage (Sadler-Smith, 2015; Wallas, 1926); manifesting the creative process to be consisting of both conscious and unconscious work.

Guilford proposed creativity to be a part of intelligence (1950; 1956) and assumed that as traditional IQ tests with closed questions measure convergent logical thinking, creativity would be measured with open-ended divergent thinking tasks (Guilford, 1956). However, aside from measurement, Guilford (1956; 1967) considered the creative process to be a form of problem-solving and proposed six (or five, before memory was split in two) kinds of intellectual processes involved: cognition (ability to discover and comprehend), memory recording (ability to encode information), memory retention (ability to recall information), divergent production (the process of generating multiple solutions to a problem), convergent production (the process of choosing the optimal solution), and evaluation (the process of judging whether an answer is valid).

Amabile (1983) proposed the componential model of creativity, suggesting that creativity includes three internal, within-individual components: domain-relevant skills (necessary knowledge in the relevant domain), creativity-relevant processes (cognitive processes conducive to novel thinking), and task motivation (the intrinsic motivation to be engaged in the activity); and the external component, which is surrounding environment—particularly, the social environment. The theory states that creativity requires all components present: creativity is expected to be the highest when an intrinsically motivated individual with high domain expertise and skilled in creative thinking works in a supportive environment.

Csikszentmihalyi (1997) proposed that the creative process normally consists of five stages: preparation (investigation of the problematic issues that are interesting to the individual), incubation (ideas' emergence and processing beyond one's consciousness), insight (the moment of spontaneous realization of how to solve the puzzle), evaluation (deciding if the insight is of value and worth further developing), and, finally, elaboration—translating the insight into the final product. Just the final stage, elaboration, is considered crucial in terms of fulfilling the creative potential: e.g., Thomas Edison is claimed to have said that creative genius is “1% inspiration and 99% perspiration” (QuoteResearch, 2012). That is, a great idea might never become an actual product without properly putting it into practice in the elaboration stage.

Aru (2022) compares the creative process with Lego construction, taking the simplest element of creative thinking as putting together at least two “pieces of information” in mind, which provides the insight-feeling. He describes the creative process consisting of five main cognitive operations: putting at least two “pieces” of information together (thus creating a new

“piece” of information), building the project up further from those pieces, finding and choosing the pieces of information needed, goal establishing, and elimination of the unneeded “pieces” when necessary for further creative process (Aru, 2022). The process is largely unconscious, although the unconscious part requires conscious studying and perspiration, and is directed with the goal, which is to be of subjective value for the process to be internally motivated.

The specificity of the creative process is that each particular creativity project is unique and has no existing algorithm, and thus is considered to be requiring so-called out-of-the-box thinking. By “the box” are meant the constraints that interfere with thinking in original way—previous experiences, habitual behavioral and thinking patterns, and existing examples unconsciously perceived as the “instructions to be followed”, which unwittingly prevent from creating something truly new; creative thinking occurs when the person overcomes those unconscious self-established limitations. However, this does not mean that creativity requires ignoring previous experience: in fact, it is more of building on top of previous experience (Weisberg, 2009), which requires effort and perspiration. One simply has to find the right kind of previous experience when solving a problem in a creative way.

### ***Domain-specificity of creativity***

Albert Einstein is named creative for his discoveries in physics, Salvador Dali for his art, and Leo Tolstoy for his literature works. The important feature of creativity is its domain specificity: one’s creative ability in one domain does not make one significantly more likely to be creative in another one (Baer, 2015; Csikszentmihalyi, 1990; Runco, 1987).

Historically creativity was considered a general trait (e.g. Sternberg, 1999). Popularity of such an approach was supported by divergent thinking tests’ usage, as this tool for creativity measurement takes a domain-general perspective (Plucker, 2004). However, studies show that although there are domain-general creativity aspects—like basic levels of intelligence and motivation (Amabile & Pratt, 2016; Baer & Kaufman, 2017)—actual creative performance is largely domain-specific (Kaufman, 2016; Sawyer, 2012; Baer, 2015). Dealing with the unknown of the problem involves retrieving accumulated similar problem schemas from the problem solver’s memory (Rumelhart & Norman, 1988); that is, when dealing with a creative task, one relies on his knowledge and experience (Amabile, 1983). However, the more knowledge one possesses, the more domain-specific it usually is, as “pieces of knowledge” are built on top of one another, and narrow expert knowledge requires years of studying the specific domain.

Not only domain-specific knowledge matters, but also different disciplines imply different approaches to problem-solving. With practice in a specific domain, people develop corresponding problem schemas, which affects methods and reasoning styles they tend to use in case of upcoming problems of any domain (Lehman et al., 1988). Studies suggest that in each thematic area, there are different personality traits and cognitive patterns that lead to optimal creativity: for example, for an actor to perform creatively extraversion might be required, but for a creative scientist conscientiousness would be of more priority (Kaufman, 2009).

The number of domains, however, is not defined clearly yet. The simplest distinction of domains refers to artistic versus scientific creativity (Feist, 1998). The most specific approach by Gardner (1993, 1999) proposed seven domains of intellectual and creative ability: language, mathematical-logical, naturalistic, musical, bodily kinesthetic, spatial, interpersonal, and intrapersonal, each with its own developmental history and neurophysiological underpinnings. Developing the K-DOCS creativity measurement scale, Kaufman (2012) came up with five main domains: everyday, scholarly, performance, scientific, and artistic domains of creativity.

So-called everyday creativity, which requires practical intelligence (e.g., Sternberg et al., 2000) and means the ability to quickly come up with original ideas of how to deal with everyday issues most effectively, can be considered itself a specific creativity application domain (e.g., Kaufman, 2012); however, relatively little research has focused on complex ill-structured problems in everyday contexts (Sinnott, 1989). Gladwell (2008) discusses the examples of Kurt Langer and Robert Oppenheimer, postulating everyday “practical” creativity as being of crucial importance for the implementation of any other domain-specific creativity. The reason behind it is that an individual creative in a specific domain (like mathematics in case of Langer) who lacks everyday creativity might be unable to fully unleash his creative potential due to denying everyday possibilities for bringing creative ideas into practice, whereas an individual who complements his “specific” creativity with the practical one (which is discussed using Oppenheimer’s example) can implement his specific knowledge more successfully (Gladwell, 2008). Thus, everyday creativity serves to adapt specific skills to real-world conditions—which is an important criterion of creativity itself (Cropley, 2006; Weisberg, 2006).

***Big-C, little-c, and 4C***

One is named creative for sewing a bag using his old jeans, another one for winning the Pulitzer Prize (Diedrich et al., 2018). Creativity can range from personal creativity to works of geniuses that last for generations (Kaufman & Beghetto, 2009).

Creativity research tend to pick up the dichotomy of everyday creativity, i.e., useful and novel-to-the-solver problem solving (“little-c”), which can be easily observed in casual life, and outstanding creativity, which refers to major productions and world-changing innovations (“Big-C”), which is rare (Merrotsy, 2013). Little-c is accessible for labor exploration; research on Big-C tends towards biographical case studies (Kaufman & Beghetto, 2009). Importantly, such a distinction reflects the common beliefs about creativity (Karwowski, 2009, 2014).

Little-c and Big-C creativity division, however, is mostly descriptive in its nature and is used for the sake of research convenience; in terms of underlying psychological mechanisms both little-c and Big-C creativity are different “levels” of the same process (Runco, 2014): little-c is what makes Big-C possible. Runco (2014) remarks that Big-C often differs from little-c not by the significance of the product itself, but by the social recognition (which is always partly driven by chance), and stresses that the term “creativity” should not be messed with the term “fame”, as creativity in psychological sense is not the same as social acknowledgment.

The Big-C-little-c creativity model was extended by Kaufman & Beghetto (2009), who have proposed a 4C creativity model instead: mini-c, little-c, Pro-c, and Big-C. In this model, mini-c refers to ideas and insights that are inherently small adjustments to routine activities; little-c category contains mostly the creative goals and of hobbyists and amateurs; Pro-C goes for professional practitioners who do valuable novel work but are not making historically important contributions; and Big-C, as in classical model, refers to great creative achievement that received universal acknowledgment. The four categories are not mutually exclusive; on the contrary, there are no firm boundaries, and all forms of creativity involve recombining existing concepts in a novel way (Kaufman & Beghetto, 2009). The model suggests that creative development of each particular person always starts with mini-c, then after repeated attempts the creator reaches the realm of little-c, and it takes years to achieve the Pro-c level; the final stage, Big-C, is a typically posthumous distinction, that is reserved for the elite few. The full progression in creativity from mini-c to Big-C is rare; however, Big-C has its origins in mini-c, and achieving the “higher” Pro-c level in one area does not cancel practicing the “lower level” mini-c and little-c creativity both in others and in the same domain (Kaufman & Beghetto, 2009).

The numbers of ten years (Robinson, 2010), and ten thousand hours (Gladwell, 2008), are named as necessary (but taken alone insufficient) to achieve the level of Big-C creativity.

Many traits, including intelligence, are distributed normally in the human population; suggestively the same can be said about creativity, with the majority of the population having creative potential, which actual realization depends on multiple factors. Nearly all aspects of creativity can be experienced by nearly everyone (e.g., Richards et al., 1988).

## **II part. Creativity mindset**

### ***Creativity stereotypes***

Creativity-related prejudices have long-standing historical roots in religion. Up until the XVII century the term “create” had implied meaning of “create from nothing”, being considered to be the monopoly of the Creator, i.e., God; people’s creations were claimed to be an imitation only, as people are merely God’s servants (Tatarkiewicz, 1980). Creative ability was considered a literally God-given talent dependent only on God’s mercy. The first creativity domain recognized as legitimate was art, and art alone; this opinion remained dominant up until the XX century, when creativity in science started to receive acknowledgement (Tatarkiewicz, 1980). Shortly after creativity itself became a topic of scientific research.

Whereas experts proceed on the 4-P (person, process, product, and press interaction) creativity model (Glück et al., 2002; Rhodes, 1961), highlighting the role of preparation and effort (Amabile, 2001) in a multi-stage creativity process (Aru, 2022), laypeople tend towards person-centered approach (Pavlovic et al., 2013).

At its simplest, the main creativity stereotype states creativity to be largely reserved for the gifted, truly creative people (Kerr, 2009). It can be seen in the relationship of creativity to the arts: people see performance or drawing (Glăveanu, 2014) as more “creative” than other domains, such as science, finding that as science deals with facts, creativity and imagination are irrelevant in that field (Akerson & Abd-El-Khalick, 2005).

The image of a creative person being either a mad genius or a tormented artist persists in media, popular culture, and psychology (Kaufman et al., 2006; Weisberg, 2006). Schlesinger (2002) argues that the cliché about geniuses necessarily being mad allows those who do not consider themselves creative to feel better about their own lives.

The question of creativity being general or domain-specific has its own controversies. Seeing creativity as a general construct can lead to the belief that someone creative in one area should necessarily demonstrate creativity in other areas as well, otherwise one is not truly creative; on the other hand, seeing creativity as domain-specific only can lead to the belief that

one who has talent in one domain cannot possibly be creative in other (Kaufman & Baer, 2004).

Burkus (2013) summed up popular beliefs about creativity as the following: assuming that insights should happen in a flash, out of the blue, and considering the ability to experience insights the criterion of creative talent; associating creativity with ideas' generation through brainstorming and not with long-term work; assuming that great creativity happens in isolation, through individual and not collective effort; believing that creative idea is only creative when it is completely new and is not a redesign of the known; assuming creativity to be always fun and spontaneous and not compatible with rules and planning; and expecting that truly creative product will by all means receive acknowledgment, otherwise it is just not creative enough.

### ***Implicit beliefs and mindset theory***

The clue point of creativity-related stereotypes largely comes down to an approach that there are people with a creative gift, who have an imaginative talent and can easily come up with something truly new, and those who lack such a talent and thus have no choice but to try to recombine the existing and imitate the works of the creative ones through long-term effort. The way people answer to themselves the question "Is creativity an innate talent of a person or a result of a person's actions and perseverance?" represents their implicit beliefs (Dweck, 2000) about the nature of creativity, or creativity mindset (Karwowski, 2014).

The growth vs. fixed mindset concept proposed by Carol Dweck (2006) grew out of the earlier implicit intelligence theory, which focuses on the role of two belief systems of intelligence: entity versus incremental (Dweck & Leggett, 1988; Dweck et al., 1995). A fixed mindset means holding an *entity theory*, which is a set of beliefs in the permanence of given traits or abilities, that considers them as a mostly unchangeable (fixed) part of one's personality; growth mindset, conversely, is characterized by holding an *incremental theory*, which is a set of beliefs that one's abilities are dynamic and malleable, and specifically acquirable with practice and time. Social-cognitive approach gives personal beliefs a central role as beliefs shape individuals' behavior (Dweck, 2000; 2006; 2008). Research findings suggest that implicit beliefs represent meaning systems that individuals use to interpret information; thus fixed-versus-growth mindset translates into differences in important motivational and performance outcomes: e.g., incremental views on abilities lead to choosing more mastery goals (Dweck, 2000), showing more resilience (Yeager & Dweck, 2012), better academic achievement (Stipek & Gralinski, 1996; Blackwell et al., 2007), more task

persistence and task enjoyment (Mueller & Dweck, 1998), fewer depressive symptoms and higher well-being (Romero et al., 2014), and others.

The crucial mindset consequence that shapes its most important psychological and behavioral effects are responses to failure and effort (Dweck & Leggett, 1988; Dweck, 2006). Fixed mindset is characterized by a maladaptive helpless pattern of avoidance of challenge and a deterioration of performance in the face of obstacles; growth mindset, in contrast, is characterized by the mastery-oriented pattern, which involves the maintenance of striving under failure (Dweck & Leggett, 1988). Growth mindset is associated with learning goals, in which individuals are concerned with increasing their competence, and fixed mindset is associated with performance goals, in which individuals seek to gain favorable judgments and avoid negative judgments of their competence (Dweck, 1986; Dweck & Leggett, 1988). The model suggests that for entity theorists failure is a painful, personally taken experience to be avoided; as an entity theorist lacks the intrinsic belief that it is possible to acquire the ability if it is not already there, instead of striving towards learning an entity theorist strives towards avoiding possible failures (Dweck, 2006). The difference lies in the perception of effort as well, as for ones holding a fixed mindset, falls and necessity to make an effort means a lack of natural talent, and for ones holding a growth mindset, the presence of difficulties to overcome means that the process of learning occurs (Dweck & Leggett, 1988; Dweck, 2006; Yeager & Dweck, 2012).

Dweck's growth mindset is closely related to Albert Bandura's self-efficacy. General concept of self-efficacy is defined as one's belief in his capacity to execute behaviors necessary to produce the desirable outcome (Bandura, 1977); growth mindset, in its turn, refers to the implicit belief that such a capacity can be developed through effort if necessary. Self-efficacy is different from growth mindset as one holding a fixed mindset towards a specific ability can possess a high self-efficacy at a given moment if one believes just they're the naturally talented one; such a belief, however, is vulnerable to failure, which in case of fixed mindset might act as a "proof" of the lack of talent, which can negatively affect future self-efficacy.

Basically, growth mindset refers to an internal locus of control over what happens in one's life, specifically over abilities and capabilities: these two are related but slightly distinct concepts as the locus of control is associated directly with the outcome expectations, and growth mindset relates to outcomes through self-efficacy (Nallapothula, 2020).

The current study focuses on the implicit theories of creativity known as creativity mindset.

***Creativity mindset. Specifics and relations***

Creativity mindset is a relatively new topic in creativity research: only a couple of individual studies were there (Makel, 2008; O'Connor et al., 2013) before the mindset concept was deliberately adopted to the field by Karwowski (2014), who defined the creative mindset as implicit beliefs about the fixed-versus-malleable character and the nature of creativity and aimed to adapt the general mindset theory to specifically the creativity phenomenon.

Makel (2008) did not find any significant differences in creative problem-solving among entity and incremental theorists of creativity; O'Connor et al. (2013), however, found that holding an entity theory translated into lower interest in creative thinking, lower self-reported creativity, and divergent thinking production. Additionally, O'Connor et al. (2013) found a high ( $r = .59$ ) correlation between the incremental view of creativity and of intelligence, yet low enough to consider them to be different constructs. Both Makel (2008) and O'Connor et al. (2013) used short scales for creativity mindset measurement inspired by Dweck et al. (1995) with intelligence items being replaced with creativity and taking fixed and growth mindsets as ends of a continuum. Karwowski (2014), taking into account the complex nature of creativity and his earlier findings that laypeople can intuitively distinguish Big-C and little-c creativity (Karwowski, 2009), proposed that it might be possible to adhere to both an incremental and an entity theory of creativity and developed the Creative Mindset Scale to measure specifically creativity mindsets. His findings supported his theory about fixed and growth creativity mindsets being rather independent factors than ends of a continuum (Karwowski, 2014).

Karwowski (2014) also explored the relations between the creative mindset and creative self-concept: creative self-efficacy (one's confidence in their own creative abilities) and creative personal identity (importance of creativity for one's self-identification). Both creative self-efficacy and creative personal identity were strongly positively associated with the growth creativity mindset, whereas the fixed mindset was not associated with creative self-concept variables (Karwowski, 2014). Significant positive correlations between growth mindset, creative self-efficacy, and creative personal identity were proven by Pretz & Nelson (2017).

Finally, Karwowski (2014) tested the relationship between creative mindsets and effectiveness in solving actual insight problems. The study demonstrated that a fixed mindset had an inhibiting effect on creative problem-solving. Importantly, just a fixed mindset moderated the relationship between a growth mindset and creative problem-solving: only among people with a low fixed mindset, a growth mindset was positively related to this efficiency, whereas among people with a high fixed mindset, there was a negative association

between a growth mindset and creative problem solving, although the statistical significance of the latter was not high enough (Karwowski, 2014). Such observations provide an argument in favor of consideration of both mindsets taken separately while analyzing creativity.

Puente-Diaz & Cavazos-Arroyo (2017) showed that similarly to classical mindset studies (e.g., Dweck, 2000), a growth creativity mindset consistently predicted achievement goals or mastery goals at a given task, whereas a fixed mindset was related to other-approach achievement goals (i.e., a tendency to set demonstrating competence to other people as a goal rather than expanding competence). Furthermore, the growth creative mindset was positively related to the perceived effort put into studying (Puente-Diaz & Cavazos-Arroyo, 2017).

Further research proved that people actually do not necessarily conceptualize creativity as either fixed or malleable trait but instead use both concepts while describing creative behaviors; the relation between fixed and growth in most studies were consistently negative, their strength varied between studies, with the estimates ranging from  $r = -.12$  (Karwowski, 2014) or  $r = -.10$  (Hass et al., 2016) to  $r = -.38$  (Pretz & Nelson, 2017) or  $r = -.51$  (Tang et al., 2016). Thus, in the case of creativity, fixed and growth mindsets do not necessarily have to be opposites but rather are separate dimensions.

Karwowski et al. (2019) study revealed the existence of all four classes of people: those holding high growth and low fixed mindsets, those holding low growth and high fixed mindsets, but also those holding high growth and high fixed mindsets as well as those holding low fixed and growth mindsets. The high growth-high fixed type was characterized by the highest creative self-concept (especially creative self-efficacy and creative personal identity; their creative self-concept was even slightly, yet not significantly, higher than the low fixed-high growth type's one), their creative activity and creative achievement were only moderate, and these individuals had below average creative potential (as measured by insight and fluency of thinking). High growth-low fixed type scored the highest on all scales regarding creative self-concept and actual creativity. Oppositely, the low fixed-low growth type almost consistently scored the lowest on all the measures and was considered the type that generally cares about creativity the least. Finally, the high fixed-low growth type, i.e., predominantly entity theorists, were also the ones who did not believe in their own creative capabilities (showed low self-efficacy and did not consider creativity important for their identity), however, were moderately successful while dealing with creative tasks (insight and divergent thinking). Therefore, it seems that the perception of creativity as innate unchangeable quality makes people believe that they are not creative, even if they are actually able to solve creativity-related problems and demonstrate some level of creative achievement (Karwowski et al., 2019).

### ***Creativity teaching in schools and mindset interventions***

The importance of creativity support in school classrooms has been discussed since the previous century (e.g., Bloom, 1985; Cropley, 1997; Runco, 1987). Ken Robinson's TEDxTalk (Robinson, 2006) named "Do schools kill creativity?" has been watched more than 74 million times. Schools are criticized for being rather formal and not supporting creativity education.

The strategic aim of education is to prepare students for future life outside educational institutions and to provide them with the knowledge and skills necessary. Regarding creativity being in its essence a complex ability to perform effective problem-solving, teaching creativity in schools would mean teaching how to tackle future real-world issues of different kinds. A story about a physics student from the beginning of the current paper, however, illustrates the important flaw of the existing education system: educational institutions mostly support memorizing the existing algorithms on how to solve a limited list of typical problems, but tell little about how to recombine existing algorithms to develop new ones in accordance with the needs of each particular situation. In turn, providing non-conventional algorithms—that is, thinking creatively—requires more than just memorizing.

Creative learning is especially uncommon at the higher education level where reading-style lecture remains the predominant method of teaching (Jackson et al., 2006). High-school and university students learn primarily through textbooks, lectures, and completing standard exercises, which prioritize (and thus support the development of) lower-level cognitive abilities such as declarative recall (recollection of factual information) and conceptual understanding (comprehension of accepted ideas) rather than encouraging creativity. For example, students often face trouble with coming up with an original idea for a research project (Csikszentmihalyi, 2006), as throughout their academic career they are taught how to answer questions, which does not help when the task is to come up with a question worth answering.

However, just inserting creative tasks (i.e., tasks that require creative performance) into the school program might not be enough to encourage students' creativity. Hennessey (2015) emphasizes the importance of intrinsic motivation in education, as students have to be motivated to participate in creative activities to successfully produce creative outcomes. Kalar (2020) study revealed in the context of entrepreneurial education that it is not enough for students just to be engaged in creativity-facilitating activity, but they have to believe and be confident in their own ability to be creative. The study suggests that in addition to creative activity itself the motivational aspect is of critical importance and encouraging creativity and

an individual's belief in their creative potential is essential to bring the expected creative output.

Although creativity training is generally considered an effective practice (Scott et al., 2004), it may not be as beneficial for someone holding a fixed mindset as much as it would be for someone holding a growth mindset, as those who believe that creative ability is predominantly unchangeable would likely be not motivated to actively participate in such a training and might experience stress and helplessness instead (Karwowski et al., 2019). Growth mindset is important in dealing with challenging creative tasks, as it facilitates continuous effort and participation in the creative process and prevents excessive fear of failure (Puentes-Diaz & Cavazos-Arroyo, 2017), and step-by-step long-term work and being ready to make mistakes are essential components of successful creative performance (Robinson, 2006). As the growth mindset concept is closely related to the learning process and its psychological perception, its support is especially important in educational environments (Paek & Sumners, 2017). Teaching creativity requires a teacher's growth creativity mindset as well, as teachers who consider creativity to be an innate talent, usually don't perceive every student to possess creative potential, which is necessary to foster an environment in the classroom that would support the creative development of all students (Paek & Sumners, 2017).

One of the main factors that influence mindsets is praise for ability vs. praise for effort: Although praise for ability and talent is commonly considered beneficial for motivation, Mueller & Dweck (1998) first found that, in fact, the effect is the opposite, and the ones who are praised for ability and for the result show worse task performance and less task enjoyment than ones praised for effort and for the process. In the case of creativity, that means that the optimal strategy for the teacher would be not praising students' for being creative nor taking students' creativity for granted, but praise for the effort they put in each particular creative task and encourage further learning in case of insufficient result rather than criticizing. That also means emphasizing not the great creativity (Big-C) as a goal, but everyday creativity (mini-c and little-c) as a process, and in case of using Big-C examples or role models, accentuating not their unique success itself, but the steps taken to achieve it (Karwowski, 2020).

Psychological interventions can initiate lasting improvements in student achievement (Yeager & Walton, 2011). Yeager et al. (2016) summed up the clue points of mindset interventions: the idea is to counteract a fixed mindset (which is the belief that one's abilities, e.g., creativity, is a fixed entity that cannot be changed with practice, experience, and learning) via providing scientific facts about the malleability of the brain, showing how cognitive abilities, which constitute creative ability, can be developed. The metaphor of the brain

developing with practice like a muscle is the relevant one; the scientific background for this idea might be explaining what neurons are and how they form a network in the brain when experience is acquired (Blackwell et al., 2007; Yeager & Dweck, 2012). Included biographic examples of persistent self-development should be about well-known individuals who would be both respected and found relatable by the target group (Yeager et al., 2016).

Due to the specificity of the creativity phenomenon, information on the complexity of creativity should be provided, which should include explaining creativity being a cognitive process and not a mystic skill, the stages of the creative process, and its domain-specificity. Aside from the demonstration that one could develop one's abilities, reasons for *why* one should develop one's abilities should be provided (Yeager et al., 2016). In the case of creativity this might be based on the notion that everyday problem-solving or self-development in activities of personal interest are of use to everyone (mini-c and little-c creativity).

### **Present study**

As the topic-related studies and literature show, creativity is a complex cognitive ability evolutionarily developed in humans to perform complex problem-solving (e.g., Weisberg, 2006). The creativity process consists of four main stages, namely preparation, ideation, evaluation, and implementation, which are united by the goal (e.g., Zeng et al., 2011). Creativity is mostly domain-specific: the more time spent practicing creative problem-solving in a certain area or domain, the more creative the person becomes (e.g., Amabile, 1983). The ability to perform creative activities is present in every individual (e.g., Richards et al., 1988), and its development depends largely on one's implicit belief in creativity being possible to be developed, which can be conceptualized as the creativity mindset (e.g., Karwowski, 2014).

As creativity is considered a crucial trait in modern society, creative activities are practiced in schools. However, studies suggest that people's implicit beliefs about their creative abilities are of crucial importance, as in the case of a fixed creativity mindset and considering themselves non-creative, the necessity to perform creative activities might lead to repulsion and self-criticism instead of active creative participation.

Informing the students about the malleable nature of creativity might have a positive impact on views on creativity and increase the performance in creative tasks and adolescents' implicit beliefs about creativity.

The aims of the current study are the following:

- to investigate the relation between creativity and creativity mindset, regarding the domain-specific nature of creativity;

- to investigate the relations between considering oneself creative, comfortableness with creative tasks, creativity and creativity mindset;
- to investigate whether informing about the malleable nature of creativity increases growth creativity mindset.

To study these questions two questionnaires were used (K-DOCS test for creativity measurement, measured once, and KCM test for creativity mindset measurement, measured twice) accompanied with additional creativity-related questions, and the following hypotheses were formulated:

- **Hypothesis 1:** Individuals with a high initial creativity mindset score have a higher overall creativity score.
- **Hypothesis 2:** The relation between the initial growth creativity mindset and the initial fixed creativity mindset is negative.
- **Hypothesis 3:** Growth creativity mindset score after the intervention is higher than the growth creativity mindset score measured before the intervention.

Apart from hypotheses testing, additional analyses relevant from the standpoint of the study were performed. Attention was given specifically to the group of students initially having troubles with creativity.

## Methods and materials

### Participants

In total, 50 high-school students participated in the study. 2 participants used their right to withdraw and did not finish the questionnaires. The final sample consisted of 48 adolescents, which included 24 males and 24 females. Participant ages ranged from 15 to 17 with  $M = 15,92$  and  $SD = 0,35$ . Participants were native Russian speakers, all fluent in English enough to participate in the study and fill out the original questionnaire versions.

### Procedure

The study took place at Tallinna Tõnismäe Reaalkool school in October 2022 through agreement with the school's teaching staff. LimeSurvey platform was used for filling out the questionnaires, which were accessed by the participants with their smartphones.

Participants were asked to fill out:

- introduction questions about their age and sex;
- the short form containing the following questions concerning their creative self-concept:

- “Do you consider yourself a creative person?” (from 1 = “not creative at all” to 5 = “very creative”);
- “How do you feel when presented with a creative task (free-topic drawing, writing, making music, choosing a topic and performing a research project, etc.) at school?” (from 1 = “I feel stressed” to 5 = “I enjoy it”).
- KCM creativity mindset self-report questionnaire to assess participants’ initial creativity mindset (Karwowski, 2014);
- K-DOCS creativity self-report questionnaire to assess participants’ creativity regarding its domain-specificity (Kaufman, 2012).

After finishing the first questioning stage, participants were presented with a short lecture on the topic of creativity phenomenon. The lecture covered the following topics, discussed in the introductory theoretical part of the current paper:

- creativity being a complex problem-solving skill not limited to the artistic domain,
  - creative process being a long-term one that consists of multiple stages and requires effort and perspiration, and is not limited to on the spot divergent ideas’ generation;
  - Big-C creativity having its roots in mini-c and little-c creativity;
- and thus malleability of creativity, with due regard for recommendations on growth mindset interventions in high school (Yeager et al., 2016).

After the lecture the participants were asked to fill out the KCM creativity mindset self-report questionnaire once again. It was accompanied with the feedback questions:

- “Did participation in the current study motivate you to rethink the concept of creativity?” (from 1 = “no” to 5 = “yes”);
- “Do you feel participation in the current study allowed you to consider yourself having more creative potential than you did before?” (from 1 = “no” to 5 = “yes”).

## **Measurement materials**

### ***Kaufman Domains of Creativity Scale (K-DOCS)***

The K-DOCS proposed by Kaufman (2012) scale consists of 50 items that tap into five creative domains: Everyday, Scholarly, Performance, Scientific, and Artistic. Everyday creativity encompasses the type of problem solving and social interactions that occur on a daily basis. Scholarly creativity encompasses academic research and non-fiction writing. Performance creativity includes acting, singing, and lyrical writing. Scientific creativity taps into all components of STEM (science, technology, engineering, and mathematics) creativity. Artistic creativity includes the visual arts as well as aesthetic appreciation. Participants were

expected to rate themselves compared to people of approximately their age and life experience for each of the statements presented in the test on a 5-point Likert scale (1 = “much less creative”, 5 = “much more creative”). Being a measurement specially constructed for domain-specific creativity measurement (Kaufman, 2012), it is less fit for single-factor (i.e. a domain-general) use, although such a solution is also possible (McKay et al., 2017).

### ***Karwowski Creativity Mindset test (KCM)***

The Creative Mindset scale proposed by Karwowski (2014) consists of 10 items that are to measure participants' mindset on creativity. Participants were expected to rate their agreement with the statements presented in the test on a 5-point Likert scale (1 = “definitely not”, 5 = “definitely yes”). Classical mindset studies (e.g., Dweck et al., 1995) take fixed and growth mindsets as the ends of a single continuum; findings by Karwowski (2014) supported with findings by Hass et al. (2016) and Karwowski et al. (2019) suggest to take growth and fixed mindsets, at least in case of creativity, as separate dimensions.

### **Ethics**

Participation in the study was voluntary. Participants were informed about the general topic, i.e. creativity, but were naive to the mindset aspect. There was no reward intended for participation, and participants were informed about their right to withdraw at any time. Each participant has given a written informed consent agreeing to the future uses of the data received for educational scientific purposes in statistical anonymous form. Participants were asked to fill all the forms using a made-up free-form pseudonym so it would be possible to link all the different questionnaires together but not the reported data with the personal ID of the participant. The collected data is to be used only for the needs of the current research.

### **Data analysis**

Statistical analyses were conducted using Microsoft Excel and JASP (version 0.14.1).

Almost all raw items from both KCM and K-DOCS scales, as well as additional questions, were approximately normally distributed: in case of most of the items skewness and kurtosis did fall within the range  $(-1;1)$ , with a few exceptions. The most significant deviations from normality had the items “Practice makes perfect—perseverance and trying hard are the best ways to develop and expand one's capabilities” and “It doesn't matter what creativity level one reveals—you can always increase it” from the KCM scale, in which agreement answers

largely predominated; tendency of these items to receive predominantly positive answers was observed in the original Karwowski (2014) research.

For the further analysis the items from KCM and K-DOCS scales were counted into factors. KCM items were counted as to form separate fixed creativity mindset and growth creativity mindset factor scales. K-DOCS items were counted as to form 5 domain-specific creativity scales and as to form a domain-general creativity scale.

## Results

The descriptive statistics of all the scales formed for the needs of the study are shown in Table 1.

**Table 1**

*Descriptive statistics (all measured data)*

	M	SD	Skewness	Kurtosis	Min	Max	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>
AGE	15.917	0.347	-1.355	4.964	15.000	17.000	16.000	16.000	16.000
CONSIDER	3.688	0.879	-0.506	0.682	1.000	5.000	3.000	4.000	4.000
COMFORTABLE	3.813	1.179	-1.002	0.526	1.000	5.000	3.000	4.000	5.000
GROWTHBEFORE	4.096	0.459	-0.709	-0.006	3.000	4.800	3.800	4.200	4.400
FIXEDBEFORE	2.675	0.561	0.619	0.462	1.600	4.200	2.350	2.600	3.000
EVERYDAY	3.742	0.657	-0.477	-0.051	2.091	4.818	3.341	3.818	4.273
SCHOLARLY	3.525	0.707	0.012	-0.584	2.000	5.000	3.068	3.455	4.000
PERFORMANCE	3.071	0.874	-0.193	-0.644	1.300	4.900	2.400	3.100	3.650
SCIENTIFIC	3.053	0.834	0.012	-0.968	1.556	4.556	2.417	3.111	3.667
ARTISTIC	3.377	0.808	-0.527	-0.306	1.556	4.667	2.889	3.500	4.000
ALLCREATIVITY	3.370	0.570	-0.119	0.096	1.840	4.420	3.035	3.230	3.795
GROWTHAFTER	4.225	0.561	-0.291	-0.382	3.000	5.000	3.950	4.200	4.650
FIXEDAFTER	2.704	0.982	0.472	-0.529	1.000	5.000	2.000	2.600	3.600
RETHINK	4.146	0.825	-0.520	-0.666	2.000	5.000	4.000	4.000	5.000
RECONSIDER	3.938	0.909	-0.406	-0.696	2.000	5.000	3.000	4.000	5.000

### Hypothesis 1

Correlational analysis was performed to test if individuals with a higher creativity mindset score have a higher overall creativity score. It was observed that neither growth ( $r = .09, p = .54$ ) nor fixed ( $r = .08, p = .59$ ) creativity mindset did not correlate with overall creativity score, thus hypothesis 1 was not confirmed.

Additionally correlations between both growth and fixed creativity mindset and each of creativity domains were checked (see Table 2). The only close to significant correlation revealed was a weak correlation between growth mindset and scholarly creativity ( $r = .26, p = .07$ ).

**Table 2**

*Correlations between growth and fixed creativity mindsets and creativity subscales*

		Pearson's $r$	$p$
GROWTHBEFORE	EVERYDAY	0.173	0.239
GROWTHBEFORE	SCHOLARLY	0.262	0.072
GROWTHBEFORE	PERFORMANCE	-0.149	0.313
GROWTHBEFORE	SCIENTIFIC	-0.016	0.914
GROWTHBEFORE	ARTISTIC	0.094	0.525
FIXEDBEFORE	EVERYDAY	0.125	0.397
FIXEDBEFORE	SCHOLARLY	0.037	0.802
FIXEDBEFORE	PERFORMANCE	0.085	0.564
FIXEDBEFORE	SCIENTIFIC	0.088	0.551
FIXEDBEFORE	ARTISTIC	-0.041	0.783

Both answers to the questions “Do you consider yourself a creative person?” ( $r = .57, p < .001$ ) and “How do you feel when presented with a creative task?” ( $r = .33, p = .02$ ) significantly correlated with overall creativity score. No significant correlations between answers to these questions and neither of the mindset scales were observed.

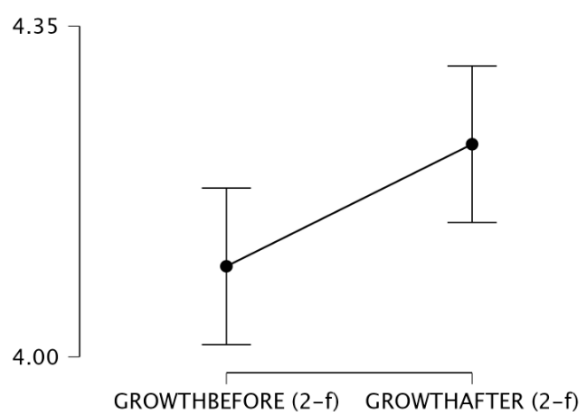
Independent samples t-test showed that initial growth creativity mindset tended to be higher in females than in males ( $t(46) = 1.87, p = .06, d = 0.54$ ), while initial fixed creativity mindset tended to be the opposite ( $t(46) = -1.35, p = .18, d = -0.39$ ), although statistical significance was below the confidence level.

## Hypothesis 2

Correlational analysis was performed to test if the relation between initial growth creativity mindset and initial fixed creativity mindset is negative. No significant correlation was observed ( $r = -.06, p = .68$ ), thus hypothesis 2 received no confirmation.

## Hypothesis 3

Paired samples t-test was used to check if growth creativity mindset score after the intervention is higher than growth creativity mindset score measured before the intervention. Statistically significant difference between the scores was observed ( $t(47) = -2.22, p = .03, d = -0.32$ ) and thus hypothesis 3 was confirmed (see Figure 1).

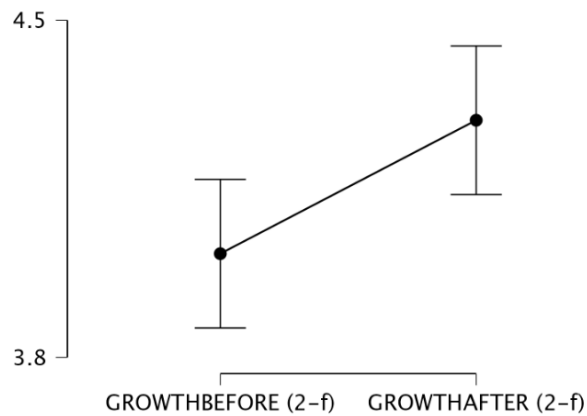


**Figure 1.** Growth creativity mindset score before and after the intervention (the whole sample)

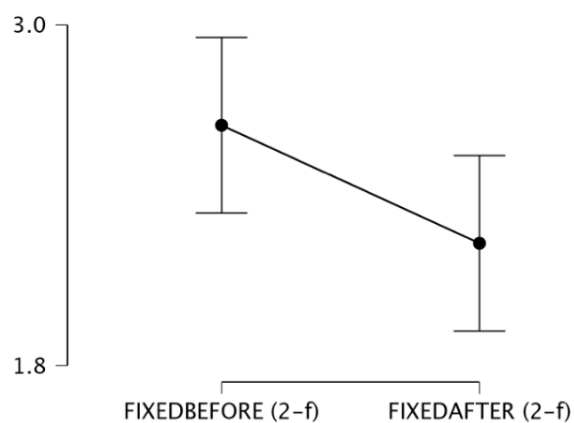
The same analysis concerning fixed creativity mindset before and after the intervention did not reveal any statistically significant difference ( $t(47) = -0.23, p = .82$ ).

As from the standpoint of the current study individuals who had initially a more struggling relationship with creativity are of the most interest, hypothesis 3 was checked specifically on the sample of those, whose answers to the first two questions (“Do you consider yourself a creative person?” and “How comfortable do you feel when presented with a creative task?”;  $r = .52, p < .001$ ) fell under 25th percentile.

Paired samples t-test showed that in case of the group specifically with a struggling initial relationship with creativity, statistically significant difference in reported mindset before and after the intervention was observed in case of growth mindset ( $t(12) = -2.77, p = .02, d = -0.77$ ), see Figure 2. Difference in fixed mindset before and after the intervention was very close to significant as well ( $t(12) = 2.07, p = .06, d = 0.57$ ), see Figure 3.



**Figure 2.** Growth creativity mindset score before and after the intervention (the group specifically with a struggling initial relationship with creativity)

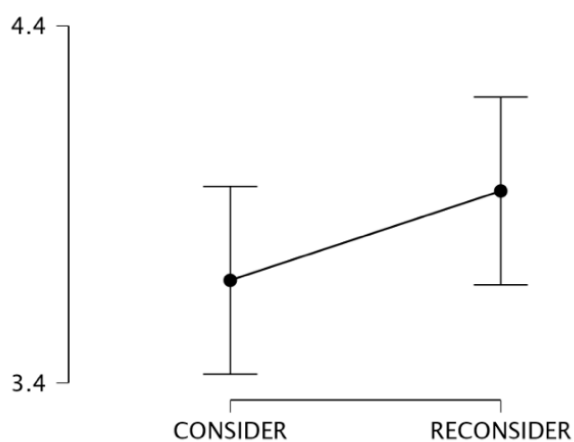


**Figure 3.** Fixed creativity mindset score before and after the intervention (the group specifically with a struggling initial relationship with creativity)

The opposite group was formed from those individuals who had the most positive initial relationship with creativity. It was formed from those, whose answers to both of the first two questions were higher than 75th percentile. In that group no statistically significant differences before and after the intervention were observed neither in growth ( $t(14) = -0.29, p = .774$ ) nor in fixed ( $t(14) = -0.31, p = .758$ ) creativity mindset.

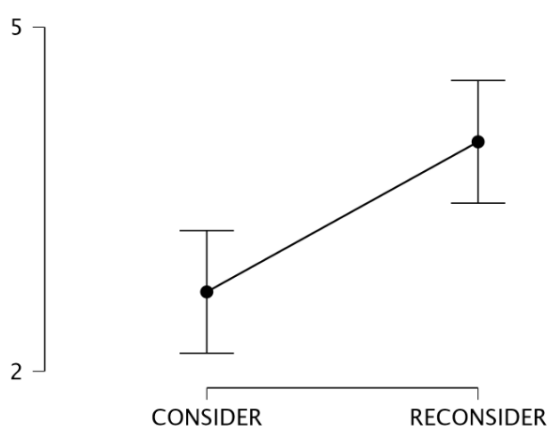
Additional measures to check the efficiency of the study were the two feedback questions “Did participation in the current study motivate you to rethink the concept of creativity?” and “Do you feel participation in the current study allowed you to consider yourself having more creative potential than you did before?” ( $r = .49, p < .001$ ). Paired samples t-test did not show statistically significant difference between the answers to the pre-intervention question “Do you consider yourself a creative person?” and post-intervention question “Do you

feel participation in the current study allowed you to consider yourself having more creative potential than you did before?” ( $t(47) = -1.35, p = .18$ ), see Figure 4.



**Figure 4.** *Considering oneself creative before the intervention and reconsidering oneself having more creative potential after participating in the study (the whole sample)*

However, in case of the same group as in the analysis above of those having initial struggling relationship in creativity (answers to the first two questions regarding considering oneself creative and comfortableness with creative tasks fell under 25th percentile), there was a statistical difference observed between the answers to the questions “Do you consider yourself a creative person?” and “Do you feel participation in the current study allowed you to consider yourself having more creative potential than you did before?” ( $t(12) = -3.77, p = .003, d = -1.05$ ), see Figure 5.



**Figure 5.** *Considering oneself creative before the intervention and reconsidering oneself having more creative potential after participating in the study (the group specifically with a struggling initial relationship with creativity)*

## Discussion

This study focuses on the construct of creativity and specifically its malleability, whether laypeople on the example of high-school students are acquainted with the essence of the creative process, and are aware that creative ability is present in every individual and can be developed through effort and dedication. The aim of the study was to investigate whether informing about the malleable nature of creativity increases growth creativity mindset, as well as to examine the relations between creativity mindset, creativity regarding its domain-specificity, considering oneself creative, and comfortableness with creative tasks.

### *Relation between creativity and creativity mindset*

Contrary to expectations, no relation between creativity mindset (neither fixed nor growth) and creativity (neither overall nor its domain-specific subscales) was observed, thus hypothesis 1 was not confirmed. The only close to significant correlation was weak correlation between growth mindset and scholarly creativity, the reason behind it might be that those more dedicated to academic research (encompassed by scholarly creativity subscale) might happen to be more familiar with the topic of creativity and its malleability. The previous findings on relations between mindsets and creativity mostly suggest a presence of a certain relation: e.g., Karwowski (2014) found that fixed mindset correlated negatively and growth mindset was associated positively with effectiveness of insight-problem solving, albeit both relations were weak; further Karwowski et al. (2019) study suggested that the relation between mindsets and creative performance is more complex and is determined by both of the mindsets scales, i.e., not just fixed or growth mindset taken separately, but their interrelation. As the size of the sample in the current study was very small (only 48 people), it was not possible to investigate the more complex underlying relations between mindsets and creativity across domains.

Considering oneself creative, which is the simplest question regarding creative personal identity (Karwowski, 2014; Karwowski et al., 2018), and comfortableness when presented with a creative task, however, both significantly correlated with overall creativity score. As creativity measurement tool was a self-report questionnaire which requires subjective comparing oneself with their counterparts, it can be expected that such a self-evaluation would be related to self-identification as a creative person.

The positive relation between considering oneself creative and creativity is also consistent with the findings on topic of creative personal identity: to be more motivated to be engaged in creative activity it is important for one to consider creativity as something important

to one's personality (Karwowski, 2014; Karwowski et al., 2018); those, who generally don't care about creativity, are proposed to not find creativity fixed, but rather not having no beliefs regarding creativity due to considering it personally unimportant, having low both fixed and growth creativity mindset (Karwowski et al., 2019).

### ***Fixed and growth mindset relation***

Counterintuitively, there was no negative correlation observed between fixed and growth creativity mindsets, thus hypothesis 2 received no confirmation. Although classical intelligence mindset studies took fixed and growth mindsets as the ends of the continuum (e.g., Dweck et al., 1995), specifically mindset studies tend to show only weak negative relation between the scales, which led to distinguishing the factors (e.g., Karwowski, 2014). Most studies tend to reveal at least a weak negative correlation between the mindsets, however, in creativity research they were generally proved to be essentially independent factors not being the opposites of one another; this is supported by series of analyzes of the KCM structure as a measurement scale (Karwowski et al., 2019). Therefore, although the result is not exactly in line with the previous research, factors' unrelatedness is generally not surprising.

### ***Informing about the malleable nature of creativity and growth creativity mindset***

The main aim of the current research was to test if informing about the malleable nature of creativity and specificities of creative process might increase one's growth creativity mindset and thus increase one's belief in their creative potential and capability to increase it.

The majority of the participants possessed a high growth and low fixed creativity mindset from the beginning of the study, considered themselves creative and were highly comfortable with creative tasks at school, thus the sample chosen turned out to be suboptimal for the needs of the research. However, there were also people, who did not consider themselves creative and who reported feeling stressed when presented with a task requiring creative performance; this group of the people having an initial rather struggling relationship with creativity received specific attention in terms of analysis of the results, as just the people uncertain in their creative ability were the target audience of the study.

Despite initial growth creativity mindset being already high, growth creativity mindset measured after the intervention lecture was found to be significantly higher in the whole sample than initial one, thus hypothesis 3 received confirmation. The difference in mindsets was also checked separately on the subgroups of participants, who initially scored the lowest in terms of considering themselves creative and feeling comfortable with creative tasks, and those, who

scored the highest. In the case of the creativity-struggling group taken separately, not only growth creativity mindset was found to be significantly higher after the intervention, but also the initial higher fixed mindset after the lecture turned out to be lower (the effect that was not observed in the whole sample taken at time). In the opposite group of creativity-comfortable people taken separately, however, no significant differences in mindset (neither growth nor fixed) before and after the lecture were observed.

Participants were also presented with a feedback question if they felt that participation in the study allowed them to consider themselves having more creative potential than they did initially, which was matched with the question regarding initially considering oneself a creative person. In the case of the whole sample, although the tendency to reconsider themselves having more creative potential than they did initially was observed, it lacked necessary statistical significance. In the creativity-struggling group, however, individuals strongly and significantly reported reconsidering themselves as having more creative potential compared with their initial creative self-identity.

The results of the study suggest that such sessions informing about the specifics of creativity are indeed effective in terms of increasing growth mindset in students, especially in those, who initially don't consider themselves creative and lack confidence in their creative performance. Although the majority of the students in the sample experienced no difficulties with creativity from the very beginning, they also had less lucky counterparts, who might benefit from such awareness-increasing interventions not only in terms of new creativity-related information, but also receiving psychological support and developing more confidence in their creative potential.

For the people holding rather fixed, entity beliefs about their creative ability, it might be especially uncomfortable to be surrounded predominantly by the people comfortably performing creative activities, as it might convince them further in their implicit belief that creativity is a fortuitous gift, that is present in those people around, but unfortunately is not their own strong side. In the current sample it was observed that initial growth creativity mindset was more present in girls than in boys, and there was an opposite tendency in case of fixed creativity mindset; in such a case, those boys feeling less comfortable with creative activities might form implicit beliefs about creativity being rather girls' talent, and continue taking for granted their own lack of creative success. As the current study suggests, it might be beneficial for such students to participate in creativity-related events which would raise their awareness about creativity being malleable and possible to develop by every person.

Speaking of previous studies on intentionally influencing creativity mindsets, Karwowski et al. (2020) study revealed that pre-informing about Big-C creativity primes fixed mindset and pre-informing about little-c creativity primes growth mindset. In the current study it was tested, which effect on mindset (and, specifically, growth creativity mindset) has the informing about the essence of creativity as a complex phenomenon, including existence of both Big-C and little-c creativity (specifying that the former has its roots in the latter). As the results of the current study suggest, providing general information about creativity—it being a complex problem-solving skill not limited to the artistic domain, creative process being a long-term one that consists of multiple stages and not limited to accidental insights, and accentuating not the independence, but the interrelation of Big-C and little-c creativity—can act as a tool to increase growth creativity mindset.

### **Limitations and future directions**

There were a few limitations that should be taken into account regarding the present study and planning future research.

Firstly, the current study was carried out on a very small sample, so it was not possible to investigate the relations between mindsets and creativity in its full due to limited data available; ecological validity also leaves much to be desired. To investigate the situation with creativity and students' creativity mindset in schools, more studies in different schools involving students of different ages are needed.

Secondly, in the current study students demonstrated an initially very high level of growth creativity mindset. This might be partly effect of priming and social desirability, as although the participants were not aware about the mindset aspect of the study, the topic of creativity was announced, and the participants might have tried to provide the answers “that would match the expectations of the investigator”, which might not represent their actual creativity-related beliefs. Social desirability is a general failure of a growth creativity mindset scale, as people tend to agree with the items, however, neither the answer itself might not necessarily represent one's honest opinion, nor knowing that something is right does not necessarily mean it holding as an inner belief (for the full discussion about the reliability of the growth and fixed creativity mindset factors in the CSM scale see e.g., Karwowski, 2014; Karwowski et al., 2019).

Thirdly, there was only a self-report questionnaire used to assess the participants' creativity, so there was no actual creative performance measured; as self-report questionnaires

as well, in fact, assess more of people's beliefs regarding their creative ability rather than creativity ability as itself, further studies could focus more on creative performance instead.

Finally, the intervention lecture on the topic of creativity was conducted by the author of the current study within their capabilities and preparation, so it can be assumed that a more informative and more well-presented lecture might have a comparatively better effect.

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### **Avaldamise nõusolek**

*Käesolevaga kinnitan, et olen korrektselt viidanud kõigile oma töös kasutatud teiste autorite poolt loodud kirjalikele töödele, lausetele, mõtetele, ideedele või andmetele.*

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*Alisa Andros*