

The Paradox of Creative Thinking Skills in the Vocational Technology Classroom: Where do Technology Teachers go Wrong?

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Abstract

In light of the growing body of research on the integration of creative thinking skills into technology and vocational subjects, teachers and academics should be given a fundamental understanding of creativity and its significance in these domains. Some of theoretical accounts have called for a study that will deal with basics of creativity in the vocational aspect as most teachers continue to demonstrate low or inadequate conceptualisation. Henceforth, the discussions contained in this study are case-specific and therefore leave no room for generalizations, but their findings have a major impact on how technology learners are trained in their classrooms. We consider it necessary to organize literature on this topic by consulting the Curriculum Assessment Policy Statement, an official document for teaching technology in senior phase schooling amongst others. We delve into this conceptual approach to promote the understanding and implementation of creative thinking skills in technology education as a priority aspect of learners' psychomotor skills. Findings indicate that critical thinking skills are severely impaired and that there is still a lack of empirical literature to help teachers foster creative thinking in technology classroom. It is recommended that teachers conceptualisation of creative thought be taken from its origin as it has gained some distortion in the over the years. Recent contributions about critical thinking skills should wedded with its origins.

Keywords: Creative thinking; Creative process; Learning environment; Digital technology.

1. Introduction

It is widely acknowledged that thinking is the root of creative thinking, and that thinking is an essential talent in the technological and vocational fields. Dewey (1934) describes thinking as a skill that requires a high level of intellectual competency and is strengthened by experience. Without experience, thinking may not be able to develop. For this reason, it is crucial to examine the concept of thinking from its inception. According to Ratner (1939), thinking is a continuous occurrence of

uncertainty being experienced and that it is provocative to one sense of beliefs - its purpose is aimed at developing knowledge and constitute a firm state of balance. Furthermore, thinking is an overall investigation for answers and requiring a thinker to acquire an integrated way of conducting an enquiry (Mtshal, 2023). Lewis (2006) and Ohemeng-Appiah (2014) suggest that it is crucial for technology teachers to always give learners activities that are timely and provoke them to think. This means that teachers should create an authentic problem that will stimulate learners' thinking and

challenge learners to put effort into coming up with solutions to technological problems.

Mirroring Vygotsky's work, Holzman (2006) argue that one idea is never enough to provoke creative thinking, meaning that technology teachers should provide the necessary support for learners to be able to generate as many ideas as they can, examine the ideas until they come up with the best suitable idea. Thinking in technology classroom is a vital process that affords learners with the opportunity to be in a position to simplify a technological problem for understanding after of which learners will be able to forestall possible solutions to the problem presented before them (Patricia, Isaac & Manto, 2023). In their study, Kekana, Mtshali and Ramaligela (2023) state that technology teachers do not always give learners a pool of ideas to generate their creativity from, even to those with special learning needs – making it difficult for learners to actualise creative thinking skills.

In this study we are on the premise that Technology teachers do not invoke adequately all the steps that can make their learners to become creative beings, and this has a lot to do with their pedagogical deficiencies. From previous discussions we have now determined that technology teachers have a different view on how they integrate creativity when teaching technology concepts. Hence, in the next segment, we discuss creative thinking (CT) in detail, this is the part that technology teachers should be familiar with because this is at the heart of where policy meets implementation.

2. Creative thinking process

The creative thinking process cannot be divorced from the technological design process because they both require learners to be innovative problem-solvers, critical brainstormers and rely on working with others. Technology is a hands-on intensive subject where learners need to engage with various tools and equipment to gain competency skills and ultimately grow their psychomotor skills (Mathabata, Kola & Mtshali, 2022). So, the creative aspect begins when a teacher plans an

activity. Technology teachers need to be conscious that any activity given to learners should promote collaboration. For instance, when learners are tasked with digging a small trench in a school yard in order to dump all littering around the school, they need learners who will use pick hoe to dig, others with shovels to pick up loose soil and those responsible for all safety concern. The learners who are involved in safety they need to creatively think about their role which includes checking up of personal protective clothing and provide water for those who will need them since they will be working on the open site.

Creative thinking skills is essential to compete and succeed in the current and future global economy (Utami, Yani, Zain & Setyasih, 2023). Technology as a learning area in the South African curriculum is aimed at developing critical and creative thinking skills through the design process. If learners' creative thinking skills is well developed, it places the learner in better position to become competitive enough in the global spectrum. As mentioned earlier, the creative process is a method that has historically included several steps, including problem formulation, information collecting, conceptual fusion, and evaluation of fresh concepts (Montag, Maertz & Baer, 2012). The creative process is an important facet in enhancing creativity. Moreover, it is a process that goes beyond classic logic in encouraging people to think diversely and innovatively (Cefkin, 2010). The creative process involves freedom from functional rigidity in driving unique solutions to a problem (Kim, 2006). In addition, it is important to make time for creative thinking activities as the creative process requires time and collaboration.

The flipped classroom method, for example, allows teachers to plan higher-level creative thinking activities during class time, as learners prepare content and written exercises for the lesson at home in advance (Lo & Hew, 2017). In a study by Sibiyi, Mtshali and Ramaligela (2023) when exploring the use of Augmented Reality to promote equity and inclusion when teaching graphical communication and graphical techniques in the Technology classroom found that technology teachers, to a

great extent, cannot integrate augmented reality tools during the teaching and learning of graphical communication and graphic techniques. This suggests another deficiency in employing creativity in the classroom. The new technologies emerging in the educational space are grounds for becoming creative in all aspects of teaching.

In a historical thread by Eriksson (1989) who conducted a study about the development of creative thinking skills through an integrated arts programme for talented children. Eriksson claimed that creative thinking should be explored through sensory stimulation, problem-solving and through reflection. Disappointingly, no trace of studies in South African context that has expanded into this exploration. Similarly, Meintjes and Grosser (2010) conducted a study focusing on creative thinking in prospective teachers looking specifically to the status quo and the impact of contextual factors, the same can be construed.

A creative learner should be able to develop and apply a set of skills to be used in the creative process. It includes being able to do the following:

- Clarify, analyse and re-define the problem or question to reveal new perspectives.
- Ask thoughtful questions.
- Identify connections between seemingly unrelated subject matter.
- Challenge known knowledge through questioning: of how can this be improved?
- Recognise available options possibilities.
- Look at things from a different point of view.

The development of learners learning experiences should be embedded in the design process and be supported by the process of purposive design, which is creative and interactive (Goodyear & Retalis, 2010). Blamires and Peterson (2014) argued that creative process is a process that usually takes place within subject disciplines as creativity

requires knowledge and skills to cater it with a purpose. In the creative process, the process is as important as the final product (Fürst, Ghisletta & Lubart, 2012). Relative to the above information it is clear that the creative process is very important in teaching and learning particularly in infusing creative thinking skills of learners. It provides necessary insights to teachers in particular with the know-how in preparing learners to acquire the correct set of skills to be creative.

3. Fostering creative process

The fact that creativity requires not just knowledge and understanding of the subject under investigation, but also a willingness to question and be unrestricted by preexisting knowledge, is one element of the creative process that adds to its potency. This means that in order for learners to understand the end product of the activities given to them, imagination should play a crucial part and assist them to question what they already know (Robinson, Neergaard, Tanggaard, Krueger, McCracken, & Matlay, 2016). It is challenging for someone to think creatively when they lack the knowledge required for creativity, which represents a balance between knowing and liberating oneself from the knowledge (Sternberg, 2012). An inclusive design approach might involve the user in the design process to give a genuine experience, but Best, MacGregor and Price (2017) caution that many examples of this kind do not truly reflect the needs of the user.

The development of creative thinking skills received increased attention in the middle of the 20th century when psychometric scholars such as Guilford and Torrance focused on extending and assessing an individual's creativity. It was uncovered that like most behaviour, the creative activity probably represents, to some extent, many skills that are learned. There are several factors, (for example, motivation, self-initiative) that are important to the development of creativity. Motivation is one of the factors that is viewed as a driver for creativity in the classroom (Sternberg &

Lubart, 1996; Starko, 2013; Agnoli, Runco, Kirsch, & Corazza, 2018). Creative Thinking Skills are developed through higher levels of intrinsic motivation that comprise of challenge, freedom, resources, group work features, supervisory encouragement and organisational support (Amabile, 2018; Vejian, Kamarudin, & Kadir, 2016).

According to Morrison, Ross, Morrison and Kalman (2019), most teachers would start by suggesting proper techniques, such as giving learners a design journal, make them draw more, let them explore rather than forcing them to take one single approach. These techniques may lead to an increase in learner's level of creativity, but the bigger picture should be on what causes one to improve or develop in creativity? Knowledge, mastery of that knowledge, and motivation from within the learner and the classroom, and the ability to be able to interrelate this information and explore cross-disciplinary relationships (Copeland, Furlong, & Boroson, 2018).

The driving of element influencing creativity is motivation - this concept emphasizes how creativity develops with better standards of intrinsic motivation. Six tactics are included in it, which includes challenge, freedom, resources, work-group features, supervisory encouragement, and organizational support (Barak, 2010; Amabile, 2011; Zhao, & Zhu, 2014). Details of these strategies are summarised as follows:

- Challenge

Challenge is said to be a method for developing the five essential qualities that enhance creativity among learners, namely, tolerance for ambiguity, tenacity, readiness to learn from experience, openness to new things, and risk-taking spirit (Sternberg & Lubart, 1996).

- Freedom

Freedom in creativity is viewed as a process that allows learners to handle problems in such a way, they can exercise their expertise and CTS to their best ability (Amabile, 2018; Jones, 2019). Learners will be able to determine their process and reorganize their prior knowledge,

new expertise, and new cognitive skills to solve the problem through collaboration, sharing, compromising, and decision-making (Csikszentmihalyi, Montijo, & Mouton, 2018). Instead of teaching learners using strictly designed problems, learners must be provided with the platform to identify their problem to be solved to allow them to exercise their creativity (Amabile, 2018).

- Resources

An environment needs to be conducive to the learners' learning or working style, despite working individually, in pairs or a group. Besides, it is vital to provide learners with a physical space needed to work comfortably (Amabile & Kramer, 2011). An environment can be considered holistically to include the political climate, interpersonal dynamics, physical surroundings, tools, and resources accessible for a project (Sternberg & Lubart, 1995). Importantly, the simplest and most vital resource of all is the time factor. Teachers should afford learners with the opportunity to explore ideas, but not for too long that the project idles. The need for exploration must be balanced with the time and financial expenses of doing so. (Amabile, 2018).

- Workgroup features

Hawlina, Gillespie, and Zittoun, (2019). Diversity and conflicts in groups are some factors that bring about dynamic and productive ideas. In contrast, if a group's participants are chosen from a variety of backgrounds to tackle a problem, the results will be more creative than those of a group of participants with similar backgrounds (Glăveanu, 2011).

In most cases groups that are made up of learners who think alike, the likely wood is that conclusions will be reached quicker, and learners be content about it, but failing to debate and explore ideas (Amabile, 2018). Diversity in a group means various, expertise, creative thinking styles and cognitive abilities will come to play a key role in creativity, and this allows the flow of dynamics and discussions as well as encouraging sharing of

ideas and exploration of divergent ideas (Runco, 2014).

- **Supervisory Encouragement**

The supervisory engagement can be conducted in various ways, for instance offering feedback, which will provide a proper structure to learners who seem overwhelmed by a task. Therefore, to successfully develop creativity, teachers should ensure that they encourage curiosity, exploration, confidence, risk-taking and balance among learners (Molderez, & Fonseca, 2018).

- o Curiosity and desire to explore are the most vital factors to build towards creativity; the first step in achieving creativity is the cultivation of creativity (Csikszentmihalyi, et al., 2018).

- o Teachers should always provide support to their learners and reward exploration to enhance creativity (Molderez, & Fonseca, 2018).

- o Self-confidence helps learners to be mentally strong and resilient, and this enables them to master their perception and work while acquiring confidence, concurrently. Learners who lack confidence and are fearful in abilities, usually fail to produce creative work. Therefore, it's crucial to consistently promote students' efforts through feedback, as this fosters a sense of security that allows them to take risks without worrying about making mistakes (Frey, Fisher, & Smith, 2019).

A teacher's pedagogy is frequently a main driver of how learners develop and learn technology skills (Mtshali & Singh-Pillay, 2023). As a result, teachers who consistently exhibit creativity tend to boost support for and develop the trends in their learners (Glăveanu, Ness, & de Saint Laurent, 2020). Striking for balance of a classroom should always be considered by teachers to encourage creativity; the level of support being rendered should be informed by the learners' demands for spontaneity and imagination. However, it must be noted that not only oppressive environment that can kill the drive of creativity in a

classroom, but there are also numerous factors involved (Sawyer, 2019).

The focus of improving creative thinking skills in a technology classroom should be on stimulating curiosity, rewarding it, offering chances for choice and discovery, and teaching methods that emphasize strategies for boosting creative output. According to Kim, Lee, Spector and De Meester (2013), teachers' perspectives on subject matter, instruction, learning, and technology affect how they approach practice. While using educational technologies for effective teaching is a complicated and open-ended area, and creative teaching is complex in and of itself. Therefore, due that, it becomes rather more complex when these two intersect. Mishra, Koehler and Henriksen (2011) assert that the most effective use of educational technology tools in education must be based on a creative mind-set that values intellectual risk-taking and openness to the novel. As a result, this presents a huge challenge for all teachers.

4. Creating a learning environment

Creative learning environment is an environment that is supportive and rewarding of creative ideas. Having all the internal resources needed to think creatively is not sufficient, but some environmental support is crucial - for instance, a forum for proposing ideas, so that the creativity that a person has within can be un-leashed (Sternberg, 2006:89; Slavin, 2019). Creativity constantly absorbs information from the environment, including the values and ideologies held by its inhabitants (Wei, 2011). An environment that is good for both teaching and learning is an important aspect concerning the enhancement of creative thinking skills. Creative Learning Environment (CLE) should be an environment that is supportive and rewarding of creative ideas (Sternberg, 2006:89; Singh, Yeh, Singh, & Agarwal, 2015).

The availability of all necessary internal resources needed to think creatively alone without some environmental support might hinder the thinking capability of a person to

display some creativity (Apiola, 2013). A positive and supportive attitude toward creativity enhances its development. Again, a positive atmosphere alone is not enough to support the growth of a creative person. Parents and teachers should support and encourage their children who have creative abilities. The atmosphere should emphasize freedom and be motivating (Davies, Jindal-Snape, Collier, Digby, Hay & Howe, 2013).

In order to ensure that the knowledge learners learn better equips them to engage in creative engagement with that knowledge, it would be beneficial to change the design of learning environments in the content areas. For instance, an agricultural technology classroom should be designed such that learners are prepared to think creatively within the context of agriculture, instead of demonstrating mastery of existing content of agriculture. If it is a science classroom, it should be designed so that learners are better able to recognize research problems, offer a wide range of potential hypotheses, or be able to create experiments that would be suitable to a certain subject (s) (Richardson & Mishra, 2018).

In an environment where creativity is highly promoted, successful schools when inducing creative learning seeks to address the following:

- Valuing and celebrating the inventive and creative efforts of learners.
- Do not overcrowd the curriculum; instead, emphasize depth and a wider perspective. Time is properly controlled, allowing for chances for learners to explore, focus for extended periods of time, think, discuss, and review. Moreover, learners are also required to develop connections between the subjects and themes they are studying and to reflect extensively on the stuff they are learning.
- Promoting and broadening curriculum balanced curriculum, to widen the learners' experience in a range of subjects and activities.
- Developing classroom rules and practices that appreciate and promote creativity

- Encouraging considerable taking of chances.

An environment that fosters creativity is likely to produce positive results in an educational setting through enabling time for creative thought, recognizing innovative solutions and products, and promoting prudent risk-taking; permitting errors; visualize alternate perspectives; investigating the environment; challenging presumptions (Sternberg & Williams, 1996; Richardson, & Mishra, 2018). There are several methods for designing creative learning spaces. One of the ways is to design a learning environment that would help learners to master creative relevant skills; it should be skills that would be generally applicable to all subject areas. For instance, a school may add a class to the curriculum that would engage learners' creative activities and methods, and then encourage them to apply those methods in their other subjects. (Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci & Rumble, 2012).

According to Sawyer (2011) along with Sawyer (2015), a creative learning environment is embedded in three variants which are teaching paradox, learning paradox, and curriculum paradox. The schools and teachers that seek to promote creative learning must negotiate this.

- a) The teaching paradox: In spontaneous classroom practice that adapts to the particular requirements of the space. Teacher competence must prevail along with a vast knowledge base of planning, procedures, and structures.
- b) The learning paradox: Platforms are flexible structures that are deliberately created to lead learners as they improvise their way to satisfying content knowledge, skills, and deeper conceptual understanding in a successful creative classroom.
- c) The curriculum paradox: To lead teachers and learners down the most productive learning trajectory and toward desired learning outcomes, excellent curriculum and lesson plans are essential. The most successful curricula, therefore, are those that encourage improvisational learning within the curriculum.

The disappointing elements about learning environments is that they are not completely supportive and accommodative of the use of a person's creativity. (Amabile & Kramer, 2011). Soh (2017) as supported by Bereczki, and Karpati (2018) elaborate that although children are creative by nature, their creativity can be fostered and nurtured at school by offering them a CLE in which they can learn. Furthermore, there is a need to provide opportunities for learners to exercise and develop their creativity through the creation of things that matter to other people in order to improve their quality of life, the world, and the pursuit of an objective greater than themselves.

Bereczki and Karpati (2018) reveal that teacher's creativity and capacity to provide a creative learning environment with creative experiences, will either support or limit the learning environment in the classroom. Therefore, it is crucial to aggressively promote an environment where learners are highly supported and encouraged to embrace their differences through a range of experiences, activities, and the search of creative solutions. In truth, creativity specific classroom designs are required as well as teacher behaviours. Beghetto and Kaufman (2010) the emphases is that the significance of encouragement in nurturing creativity in a positive learning environment should encourage learners to exceed their expectations and they should be rewarded. Numerous researchers with one voice talk about the open, safe learning environment and atmosphere aimed at helping learners to enjoy school and achieve better results (Beghetto, & Kaufman, 2014). It can be quite effective to foster an innovative culture in the classroom by providing a supportive environment (Veziroglu-Celik, 2018).

5. Failure as part of creativity

Failure is an integral part of the creative processes. In particular, failure that ultimately results in success; or failure-related reflections when battling uncertainty results in introspection and the capacity to handle ambiguity. Moreover, failure is also acceptable

if it helps learners increase their creativity or gain a better knowledge of the creative process in general (Smith & Henriksen, 2016). A critical component of 21st-century thinking is creativity. However, a lot of people are reluctant to define themselves as "creative" or find intellectual risk-taking and open-endedness unpleasant (Henriksen, Richardson, & Mehta, 2017). There are lots of fears regarding failure; however, it is not often that good original work comes together for the first time. In light of this, a key method of teaching creativity in the classroom is to embrace failure, to instil more Creative Thinking skills in learners (Smith & Henriksen, 2016).

Growth and learning are negatively impacted by a fear of failure and risk (Smith & Henriksen, 2016). Teachers' willingness to try new things and fail leads them to develop creative and successful teaching strategies (Henriksen & Mishra, 2015). Robinson and Aronica (2015) indicate that for some times have closely studied the steady way of diminishing creativity, that has been occurring in recent decades. In recent years, standardised/high stakes testing, and rigid curricula or policies have prevailed, there is less motivation built into the system for both teachers and learners to be more creative or to promote creativity (Bray & Tangney, 2017).

According to Torrance (1972); Bakkenes, Vermunt, and Wubbels (2010) as most teachers only pay attention to ways for teaching for the best learning results rather than teaching for the discovery of new knowledge and creative ideas, teaching learners to be creative is a chore that teachers dislike taking on. In order to encourage creative thinking in their learners, it is crucial to train teachers to recognize the process of developing creativity. No amount of creativity education can help if math, science, and technology are still taught in a way that discourages original thought and problem-solving. Rather, it will be required to change the ways that each subject area is taught in order to make sure that learners' knowledge stimulates creativity and positive behavior in general. (Sawyer, 2015).

According to Beghetto, and Kaufman (2010); Beghetto, Kaufman, and Baer, (2014) evaluation, competition, restricted choices, conformity pressure, frequent failure and rote learning can destroy creativity in school. In a study that included interviews with National Teacher of the Year award finalists, it was revealed that a wide range of examples and cases where innovative and accomplished classroom, the teachers discussed the vitality of exploring new things, taking risks, and embracing failure, as a key to their creativity in the classroom (Henriksen, 2011).

6. Methodology

This conceptual paper was written with a goal of highlight the value of creative thinking process in the technology classroom. It was important to delve into various literature from the oldest to the current one in order to synthesise the idea of creative thinking. Only peer-reviewed journal publications that addressed the application and suitability of creative thinking techniques were used in these narratives. Search engines like Hotbot, Google, Bing, and several institutional repository libraries were used to find the pertinent articles. The key words or phrases that were utilized to choose the articles, which are in the public domain, included creativity, thinking, and creative thinking.

As a result, a purposive sample method was utilized to choose the articles for review. A total of 90 papers, book chapters, and theses were sampled altogether. These academic publications were downloaded, assigned numbers, and organized in an electronic folder. The articles were subjected to content analysis. The articles were read and re-read before coding could begin.

7. Conclusion

This study sought to explore the paradox of creative thinking skills in the Vocational Technology classroom. Through rigorous literature review, this study discovered that creative thinking skills were severely

misconstrued by technology teachers. There seems to be linear emphasis on it even in the current trends of technology education literature. This by default, makes it difficult for one to actualise the importance of creative thinking skills in a technology classroom. Therefore, this study holds that the basis of every subject should be the development of creative thinking abilities. Sustainable creative thinking can be developed for its value in the contemporary, technological, and industrialized society because it is one of the abilities needed to prosper in the twenty-first century. To think about creative development in isolation is an impossibility. There are many factors to consider in order to accommodate the development of creative thinking skills in Technology Education discipline. The teacher can direct the growth of creativity through creative process using a series of steps that promote diversity and innovation. The creative learning environment is also necessary to stimulate creative behaviours and creative thinking. Creative thinking abilities are the vital skills required for proficiency and long-term relevance to the teaching profession. Furthermore, teachers need to take advantage of the technological advances in the era of forth industrial revolution. The 4IR era has arrived; technology advancement has taken centre stage, hence technology advancement can influence how business is conducted in corporate world; how teaching and learning is conducted in schools, as well as in socialising. Therefore, the development of creative thinking skills through the integrating of digital technologies is inevitable, teachers in particular need to enthusiastically catch the wave to remain relevant today going forth.

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