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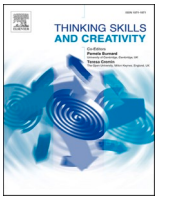

Improving self-efficacy and creative self-efficacy to foster creativity and learning in schools

Isabelle Capron Puozzo [a], Catherine Audrin [b,*]

[a] University for Teacher Education, Valais, Switzerland
[b] University for Teacher Education, Vaud, Switzerland

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ABSTRACT

Self-efficacy refers to the perception and belief that an individual has of their skills and that they mobilize effectively to succeed in a particular action (in the sense of achieving a goal). Self-efficacy has been shown to greatly influence students' results. However, creative self-efficacy, i.e., the belief that one can produce creative outcomes, has not been studied very often. In this paper, we focus on the impact of student self-efficacy and creative self-efficacy in the context of a pedagogical approach to creativity. More specifically, we set up an intervention designed to enhance students' creativity. Data was collected on 23 students. This research adopted a mixed-methods design as data were collected from questionnaires and interviews. Results show that the intervention did not have a significant impact on (creative) self-efficacy. However, participants reported a general better understanding and being more familiar with the topic after the intervention. Results are discussed and further lines of research are suggested.

1. Introduction

In the 1970's, Rogers (1972) criticized traditional education, as teaching was focusing on "the neck up" (Rogers, 1972). This highlights that teaching is complex, involving not only cognitive factors but also affective and conative ones. Self-efficacy, or the perception of personal efficacy, is an individual's capacities that has been shown to be highly involved in success or failure at school (Bandura, 2007; Bouffard & Vezeau, 2010a, 2010b; Bouffard, Vezeau, Chouinard, & Marcotte, 2006; Smeding et al., 2015; Zimmerman et al., 2000).

In this paper, we present an intervention designed to foster student self-efficacy and creative self-efficacy in the context of a pedagogical approach to creativity (Capron Puozzo, 2016a; Craft, 2005). In the following, we highlight the importance of self-efficacy and creative self-efficacy, and how these concepts are important for students.

1.1. Sociocognitive theory

Sociocognitive theory was developed by Bandura (1986) in reaction to behaviorism. This theory posits that human behavior is organized around triadic reciprocal causation. This organization is based on three interrelated factors: 1. The environment (macro-, meso- and micro-levels), 2. The individual (influenced by cognitive, emotional and biological experience) and 3. The behavior of the

* Corresponding author at: *Av.* Cour 33, 1007 Lausanne
E-mail address: Catherine.audrin@hepl.ch (C. Audrin).

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individual. These factors mutually influence each other both bidirectionally and deferred in time. Thus, the same situation will have different consequences and impacts on different individuals, as the cognitive, emotional and physical treatment of the information will be interpreted in the light of their previous experience. Bandura posits individuals' self-efficacy to be at the center of this triadic reciprocal causation. Notable, he suggests that self-efficacy allows a better understanding and analysis of individuals' behavior.

1.1.1. Self-efficacy: perceiving oneself as competent to succeed

Baudura defines self-efficacy as "the individual's belief in his ability to organize and execute a course of action to produce desired results" (Bandura, 1997; 2007, p. 12). Self-efficacy refers to the perception and belief that someone has of their skills and that they mobilize effectively to succeed in a particular action like reading or writing in language, resolve a problem in mathematics, etc.). In this study, success is understood as the capacity to achieve a goal in French as a second language. We more specifically focused on argumentation and Francophonie. Self-efficacy is not only correlated with behavior, but also with successful performance, even if the correlation is stronger in a laboratory set-up (Sadri & Robertson, 1993).

In the school context, research carried out on self-efficacy offers a new look at student motivation (Brewer, 2016; Carré, 2005, 2009; Fenouillet & Cosnefroy, 2009; Puozzo Capron, 2014): research suggests that the more a student believes in their knowledge and skills, the more they invest and persevere in carrying out tasks, even the most complex ones (Bandura, 1995). Self-efficacy is an intra-individual factor which contributes to the success of learning and schooling. Bouffard and Vezeau (2010b) showed that a student who perceives himself as more competent on entering college obtains better results in the long term, even if his initial academic results are poorer than other pupils having lower self-efficacy but better results. Developing students' self-efficacy fosters cognitive (Berger & Büchel, 2013) and emotional self-regulation (Brewer, 2013), progressively making students self-reliant (Zimmerman et al., 2000).

1.2. Creativity in schools

In this research, we are interested in creative situations in learning context. Creativity is defined as the capacity to create a product that is both "new and adapted to its context" (Lubart, 2010, p. 10). From a sociocognitive perspective (Bandura, 1986), a pedagogy of creativity consists of implementing creative learning (Craft, 2005) such that environmental (spaces conducive to creativity), emotional (positive and negative emotions), conative (letting go, risk-taking, perseverance and motivation) and cognitive (divergent, convergent and analogical thinking) factors intervene in an interdependent but not necessarily uniform way. It thus consists of promoting creative processes and action through an experiential approach. It promotes knowledge and creativity directed towards lifelong learning (Carré, 2005) and towards the development of the competence and the desire to be creative through-out life (Capron Puozzo, 2016c).

As such pedagogy requires students to implement creative micro-processes (Botella, Nelson & Zenasni, 2016), or even carry out creative acts (Capron Puozzo, 2016a), creative self-efficacy may be a central factor in students' engagement in this pedagogy. While several studies have been conducted about increasing the level of creativity in a school context (e.g.,Doron ,2016;), this study focuses on an intervention designed to increase self-efficacy as well as creative self-efficacy.

1.2.1. Creative self-efficacy: perceiving oneself as creative to succeed

Research on creative self-efficacy has typically been carried out with employees in organizational psychology (Ghafoor, Qureshi, Azeemi & Hijazi, 2011; Tierney & Farmer, 2002; Yu, 2013). This highlights the importance that creativity has for employers: creativity is now considered a key factor for companies whose employees are supposed to "adapt to ever-changing markets" (Lubart, 2010, p.1). This adaptation requires the development or reinforcement of certain professional skills. Thus, creativity has become a criterion for social evolution. Today, being creative is a fundamental requirement for "Homo Creativus" (Lubart, 2012, p.13).

While this point is clearly highlighted in companies, it should also be encouraged in school goals. School has to foster creativity in their students, who will have to evolve in an increasingly complex society: they need to be able to develop creativity for their later professional life, and school has an important role to play in this process (Craft, 2005; Robinson, 2011). By providing education that foster the desire to be creative throughout live, schools will provide new important competences.

However, to allow such life-long development of creativity, creative self-efficacy must be at stake. Creative self-efficacy is defined as "the belief that one has the ability to produce creative outcomes" (Tierney & Farmer, 2002, p. 1138) or "the perceived confidence to creatively perform a particular task" (Beghetto & Karwowski, 2017). Literature highlights that creative self-efficacy shapes the individuals' creativity and tendency to engage in creative performance or efforts to achieve creative challenges (Beghetto & Karwowski, 2017). The more the professional masters his field of expertise and the skills required, the higher his creative self-efficacy, allowing him to come up with creative solutions. Research in education highlights the importance of creative self-efficacy. Beghetto (2006)'s study on 1322 college and high school students revealed that a high level of creative self-efficacy is correlated with a positive perception of success in studies and a greater motivation to learn. Moreover, these students participated more actively in extra-curricular activities. Furthermore, correlational studies have been performed in education- Farmer and Tierney report 40 studies using samples from elementary school to university level in different countries (Farmer & Tierney, 2017). In their chapter, Farmer and Tierney highlight the importance of creative self-efficacy, and reveal that research has highlighted creative self-efficacy to be a predictor of mastery creative goal, a moderator of quality and originality of problem-solving solutions and a mediator between optimism and innovative behavior.

The correlation between creative self-efficacy and effective performance/production (abstract/concrete) has been demonstrated (Ghafoor et al., 2011; Tierney, Farmer, 2002; Yu, 2013): the more someone perceives themselves as creative, the more they call their creativity into play. As a result, the more learners perceive a high sense of self-efficacy and creative self-efficacy, the more they will come up with creative solutions while learning. However, this result found mixed support in the literature: as highlighted by

Puente-Diaz & Arroyo, 2016, creative self-efficacy has not systematically significantly been related to divergent thinking performance. Authors suggest that creative self-efficacy may be related to more subjective dimensions (such as students' motivation) than objective outcomes (Puente-Diaz, 2016). Consistent with this idea, creative self-efficacy has been shown to be positively related with reproductive and creative imagination (Puente-Díaz & Cavazos-Arroyo, 2017). More generally, the impact of creative self-efficacy on creativity is highly dependent on the measurement (Haase, Hoff, Hanel, & Innes-Ker, 2018); still, as reported by Farmer and Tierney (2017), meta-analyses generally report a consistent and moderately strong link between creative self-efficacy and creative outcomes.

Regarding teaching practices, these results show that the development of creativity is fundamental, and that teachers' feedback may be a crucial lever to increase students' creative self-efficacy.

1.3. The development of creativity, self-efficacy, and creative self-efficacy in school

In educational contexts, intervention studies have focused on enhancing creativity (notably by improving convergent and divergent thinking - Alfonso-Benlliure, Meléndez & García-Ballesteros, 2013; creative capacity – Bott et al., 2014; Kienitz et al., 2014; creative production - Byrge & Tang, 2015). Among them, few interventions have studied the impact of such intervention on creative self-efficacy (e.g., Byrge & Tang, 2015; Mathisen & Bronnick, 2009; Meinel et al., 2019; These intervention studies globally show a positive impact of the training both on creativity and on creative self-efficacy (except for Meinel et al., 2018).

In such context, it is important to provide tasks designed to lead to multiple possible answers favoring divergent thinking and thus creativity (Botella et al., 2016; Capron Puozzo, 2016c; Lubart, 2010). By doing so, they allow students to experience creativity. When students participate to these tasks and actively experience proficiency, they develop not only the perception of their skills in learning, but also the perception of their ability to be creative. Indeed, as highlighted by Bandura (2007), four elements may increase self-efficacy: (i) mastery experiences, (ii) vicarious experiences, (iii) social persuasion, and (iv) emotional states. The most important factor in the development of self-efficacy is the mastery experience and it consists in the accomplishment of successive steps of learning, where each step leads to more complex cognitive skills. Such situations "are the most influential source of information about efficacy" (Bandura, 2007, p.125). Consequently, designing and implementing a pedagogy of creativity also implies proposing tasks that are sufficiently complex that the student can come up with an innovative solution while adhering to the instructions (Lubart, 2010).

1.4. The present study

In this research, we propose a pedagogical intervention designed to stimulate creativity, by offering students different ways of learning. Adopting a mixed method research, data consist in semi-structured interviews and questionnaires designed to measure participants' (creative) self-efficacy. The purpose of this research is to observe and measure the impact of the intervention on both self-efficacy and creative self-efficacy.

2. Method

In this research, we adopted a participating observation design (Becker, 2003) in order to implement and evaluate a pedagogical intervention designed to enhance (creative) self-efficacy. A pedagogical intervention was implemented in a class of 23 vocational students (10 girls; mean age = 19) in northern Italy. The vocational school prepares them for jobs in agriculture; the intervention ended when students were in their last year and were supposed to obtain the high school diploma at the end of the year. The intervention was implemented in a French as second language course during 8 weeks. The research was conducted during three 50 min periods over 8 weeks in a course of French as a second language.

2.1. Participants and procedure

Participants were recruited as they attended a French as a second language class. The participation to the research was voluntary, and participants all signed a consent form. The research took place during two years. During the first year, students first completed a scale measuring both self-efficacy and creative self-efficacy. After this initial measure, they took part to an intervention designed to enhance both self-efficacy and creative self-efficacy before taking part to their French lesson. During the second year, students participated to a lesson where they had to present an analysis of a French text in a creative way. In the following lesson, students went through a more "traditional" lesson where they had to work in groups. The research protocol is detailed below.

The intervention consisted in implementing two creative devices focusing on drama and role playing. The general theme of both devices was about immigration. In the drama exercise, participants were told to behave as if they were a specific substance. They could be butter, iron, wood, chewing-gum, water, etc. They had to move in the room as if they were one of these substances. This part of the exercise lasted five minutes. Then, they were told that they were crossing the border of an imaginary foreign country (for example the country of wood), where another participant (who previously decided to embody wood) welcomed them with a specific move. Participants had to reproduce this move while considering the constraint of the substance they embodied. After this, participants inverted the roles: the person coming to the country made another move and the previously welcoming participant had to give a try to make this move, given their own constraint.

The role-playing device followed the Drama exercise and consisted in three different stages. Five participants took part to the first stage. Two of them were native people and had to embody iron. Three other participants were immigrant, and embodied melted butter.

The scene took place in a reception center for foreigners in the country of iron. Participants were asked to transmit specific emotions or behaviors: while the melted butter shared sadness, exhaustion and fatigue, the iron shared dedication to the others and self-giving. The second stage was designed for four participants, and took place in the country of wood. Three participants were asked to embody wood, and one embodied paper. The paper participant had to take the role of an undocumented illegal immigrant, who was pursued by the wood participants. Here again, participants were asked to share specific emotions depending on their role. More specifically, the wood participants had to transmit reject and hate, while the paper participant transmitted fear, loneliness, and willingness to flee. Finally, four participants took part to the third role playing. In this scene, two students represented steam, while the two other students embodied chewing-gums. The students could freely decide where the scene was taking place. The scenario was the following: all four participants met in the country of the steam, where the chewing-gums participants had immigrated to flee a war in their country in which they lost their families. The steam participants thus had to share an intention to reject foreigners, hate, aggressivity and violence. In contrast, the chewing-gums participants had to share loneliness and deep sadness.

Right after participating to the drama exercises and to the role-play, participants took part to a French lesson. The French lesson focused on the importance of immigration in Italy. Participants had to look for information in order to later participate to a debate regarding the immigration process in Italy. In the debate, one student took the role of a moderator, while the rest of the students were divided in three group. Two groups had to defend their opinions by being either against or for the immigration. The last group was a witness group representing various opinions (i.e., people advocating for immigration, migrants, politics, etc.). The results of this study have been published elsewhere (Capron Puozzo, 2016a).

During the second year, participants went through a French lesson designed to focus on creativity. More specifically, participants had to prepare a creative presentation on a French-speaking country. The instruction for the presentation was that it had to be creative either individually or collectively. Participants were informed that creativity could be highlighted by either creating an object which represented the country, by singing a specific song supposed to represent the culture of the country, etc. Participants were told that their presentation had to be complex, original and adapted to the culture they wanted to present. After this lesson, participants were asked to complete the same scale measuring both self-efficacy and creative self-efficacy.

Then, participants went through a second French lesson were they worked in groups on French texts. Each group of students was given different instructions. The first two groups had to prepare a comparative study between two authors (André Gide and Louis-Ferdinand Céline) – one focused on the incipit and excipit of a text of each author, the second focused on the writing style of the authors. The third group focused on one text of Céline and the last group focused on one text of André Gide. At the end of this lesson, participants were asked to complete the same scale measuring both self-efficacy and creative self-efficacy.

The three lessons were designed to enhance students' mastery experience, in order to develop students' self-efficacy. Indeed, in these lessons, students had the opportunity to observe and analyze the performance of other students. As creative learning was explicit, it is supposed to increase their sense of creative self-efficacy. Moreover, as highlighted by Bandura, the observation of someone – be it a peer or a model, can help students to get strategies for being creative, especially if they do not perceive themselves as capable of being creative. By having an active observation of creative performance (such as the creative presentation in lesson 1), the students were able to identify the characteristics of a creative production.

We hypothesized that participants' creative self-efficacy and self-efficacy would increase through time, as participants were exposed to creativity and mastery experiences.

2.2. Measurements

Students completed a questionnaire containing a scale of perceived self-efficacy (adapted from Bandura, 2006 and 2007) and a scale measuring creative self-efficacy (Ghafoor et al., 2011; Tierney & Farmer, 2002; Yu, 2013). This questionnaire was developed following the guidelines of Bandura (2006). Each item referred to different requirements of the task (e.g., carry out a literary analysis or write a story), and participants were asked to rate how much they evaluated their self-confidence on a scale of 0 (not at all) to 100 (extremely high). The questionnaire consisted of 10 questions (Bandura, 2006). Of these 10 items, six measured self-efficacy (e.g., "I feel able to conduct a literary analysis of a text by a 20th century French author") and four creative self-efficacy ("I feel able to choose a creative way to illustrate the main literary characteristics of a 20th century French author to the class"). As mentioned by Bandura, the questionnaire was adapted to the sequence studied by the students so that it: 1) was not too broad but adapted to the context, 2) measured precisely what the students did. At the end of this questionnaire, participants could freely answer open-ended questions. All 23 students answered these open-ended questions. In this research, we focus on two of these questions. The first question regarded their opinion about the creative device – participants were asked to freely assess what they thought about the creative device. The second question concerned participants' difficulty to be creative. Notably, participants were asked to assess how/if they found it difficult to be creative and to explain why so. Finally, interviews were conducted with four voluntary participants two months after the end of the study.

2.3. Data analysis and results

Qualitative data was coded with Nvivo in order to identify students' perception of the link between learning and creativity. In the coding, the words related to "learning" and "creativity" were identified. We further coded when students referred to vicarious experience or mastery experience. This was performed on all the material we had (i.e., the answered to the open-ended questions as well as the interviews).

Quantitative analyses were performed using R. To evaluate whether participants creative self-efficacy and self-efficacy improved

during the intervention, we performed a bayesian multilevel model in which we predicted participants' score based on the time of the measure (3 levels) and on the type of the measure (creative self-efficacy or self-efficacy). We chose to perform a multilevel model analysis due to the nature of our data. Indeed, we had multiple items (5 items designed to measure creative self-efficacy and 5 items designed to measure self-efficacy) embedded within 23 participants, which represent a hierarchical structure in our data. We decided to perform a Bayesian analysis because such analysis is recommended for small sample size (McNeish , 2016) along with other well-known advantages of Bayesian analyses (e.g., the ability of Bayesian framework to obtain evidence in favor of the null hypothesis, the possibility of taking into account prior knowledge,…) (van Doorn et al., 2021;).

Random intercepts were introduced for both items and participants. We introduced time (1, 2 and 3) and condition (creative self-efficacy vs. self-efficacy) as fixed factors. Model was fitted using the rstanarm package (Goodrich, Gabry, Ali & Brilleman, 2020) and used weakly informative priors as recommended by Muth, Oravecz, & Gabry, 2018. As recommended by McNeish (2016), wearkly informative priors are particularly important for small sample size studies, and are to be used when prior knowledge is absent (van Doorn et al., 2021;). Four MCMC chains of 2000 iterations each were performed, half of whom were used as warmup iterations. Thus, 4000 iterations were used to approximate the posterior distribution. We reported posterior convergence using Rhat. A Rhat close to one signifies that posterior estimates converged normally. Constant effect estimates were summarized through posterior mean and their 95% credible interval. These intervals are considered like classical confidence intervals in the Bayesian world. We also reported Bayes factors (BFs), which were computed with the bayestestR package (Makowski, Ben-Shachar, & Lüdecke, 2019). Bayes factors quantify the relative predictive performance of two rival hypotheses (in our case, H0 where the test is not significant versus H1 where it is significant). The larger the value of BF, the more data support H1. Bayes factor may range from 0 to infinite. The more a Bayes factor tends to 0, the more the estimated parameter is in favor of H0. When a Bayes factor equals 1, this indicates that both hypotheses predicted the data equally well. The greater the value of the Bayes factor, the more the estimated parameter is in favor of H1.

2.4. Results

2.4.1. Creative self-efficacy and self-efficacy

Descriptive results are represented in Table 1. These results reveal that the mean of creative self-efficacy and self-efficacy are close. While there is a small increase of creative self-efficacy across time, this result is not significant, as highlighted by our analyses.

The results of the Bayesian model are presented in Table 2. This table reports the estimated self-efficacy level in each condition and the corresponding BF. While we predicted that both creative self-efficacy and self-efficacy would increase through time, results do not support our hypotheses.

2.4.2. Qualitative data

Answers to the open-ended questionnaires show that creativity instills a more motivating environment for learning (S2: "by modifying the way we learn, we are stimulated to learn"; S3: "Creativity was stimulating because we had to understand the text but also all the context: story, policy, characters, etc."; S6:"working with other means than reading a text, the essential concepts are easier to remember"). Learning becomes more playful and challenging with a perception that concepts are easier to remember. Two students, however, mention that they saw creativity as an obstacle. As an example, S19 writes: "In my opinion, [creativity is] an obstacle because we think more about organizing than about studying the text". This answer highlights that the procedure can supplant learning despite the precautions taken. Nevertheless, there is also the idea that creativity allows: 1) to focus attention (S16:"Yes in learning, because we concentrate much more on the exposé and listen to others. We are more concentrated than in class, I would like to try again!!!"); 2) to improve understanding (S17:"important because, through this creative method, we remember the authors and the story, as a beautiful project done together, and not as a usual assessment"[1]) and 3) to remember better. One student notably said that creativity allowed « to diminish the tension of the presentation and to be in harmony with the public". The creative experience students went through let them forget that they were studying ("Creativity was a plus because it allowed us to forget that we were in school"), which increased participants' pleasure to learn. It is suggested that when students are active actors of their performance, they experience an active mastery experience. In contrast, when they become spectators of a creative performance, students go through a vicariance process ("creative presentation are tougher to do, but it is actually funny to see the others […] also, it is fun to go through original things in class"). The last point regarding vicarious process highlighted in our research is the willingness to look at other's creative performance, the pleasure of sharing an original experience. These elements leads students to be highly focus on the presentation they listen to. Notably, participants mention "concentration" multiple times (8) ("Creativity allowed us to keep the attention of all students, even when we did not to anything creative";"Yes, with a creative and fun presentation, students are more attentive"; "The emotions involved in creative performance are positive for the implication of other students" "I prefer a creative performance because the others are more implicated, and it helps us to focus on the topic of the lesson. In traditional lessons, we tend to lose our focus really fast"). This strong involvement in the presentation is highly interesting because in creative performance, students sometimes come from a vicarious process, by being an observer, to an active experience where they become actors and are involved in the performance.

The coding of the data collected after the creative performance in relation to two French literary authors, Gide and Céline, reveals the significant association between creativity and learning. The student' responses provide clear evidence that creativity promotes learning by evoking two cognitive processes only 1. That of comprehension "To learn the concepts in a different way" (E.9)"To better

[1] "It's important because this way of doing things allows us to remember the authors and their novel. It was like some beautiful thing we did together and not a traditional test."

Table 1
Descriptive analysis of self-efficacy and creative self-efficacy measurement across time.

	Mean	SD	Skew	Kurtosis	alpha
Creative self-efficacy					0.86
Time 1	57.86	11.88	−0.32	−0.6	
Time 2	60.51	10.77	−0.4	0.1	
Time 3	61.41	11.66	0.06	−0.39	
Self-efficacy					0.87
Time 1	61.14	13.6	0.3	−0.89	
Time 2	60.54	9.53	−1.02	1.99	
Time 3	61.36	10.63	−0.26	−0.82	

Table 2
Results of the Bayesian analysis.

	Rhat	Estimate (mean)	Sd	2.5%	97.5%	BF
Intercept	1	61.1	3.2	54.8	67.3	
Time (t2)	1	−0.6	2.4	−5.2	4	0.316
Time (t3)	1	0.3	2.4	−4.5	4.9	0.271
Condition (self-efficacy)	1	−3.2	3.3	−9.3	3.5	0.817
Time (t2)*condition	1	3.2	2.3	−1.4	7.5	0.651
Time(t3)*condition	1	3.3	2.3	−1.3	7.7	0.758

understand the author's style" (E.13)), 2. and restitution "A contribution, because by working with different means than reading a text, the essential concepts are easier to remember" (E.14);"Yes, for example, I would remember for the rest of my life which style Céline uses because I interpreted a character who represented his style" (E.1).

In an interview carried out a few months after the exam, S16 confides: "When I studied for the Maturity exam, I remembered my friends' scenes. It was easier than about books. I also remembered my own presentation and it was easier to remember things. The experience was quite different from others".

The processes of both vicariance (Bandura, 2007), as an observational process, and active experience of proficiency favor the appropriation of knowledge. S8 confirms this in the same interview: "It's not easy, because you have to rework all the information, modify it and personalize it. That makes it more your own and transmits what you have. This is the most interesting work, because it's your text, you invested part of yourself in it. It's not simply a fact you have learnt. You can retain it more readily, because you invested in it. It becomes a personal memory." The student then raises the question of the place of creativity at school.

3. Discussion

This research focuses on self-efficacy and creative self-efficacy. The purpose of this study was to evaluate the impact of an intervention favoring the pedagogy of creativity on self-efficacy and creative self-efficacy. We used self-reported questionnaire to measure participants' self-efficacy and creative self-efficacy. Moreover, qualitative data allowed us to investigate the potential link between students' the perception of learning and their perception of being creative. Quantitative results do not show any impact of the intervention on self-efficacy nor on creative self-efficacy. However, qualitative results suggest that students perceive the link between learning and creativity: although they sometimes perceive creativity as being difficult, they acknowledge that going through the process of creativity may help them to foster their learning. This suggests that a link between the perception of learning and the development of creativity may be drawn, thus demonstrating a virtuous circle of learning.

Our results are partly in line with previous studies who show the benefit of participating to an intervention designed to foster creativity. Notably, as Byrge & Tang, 2015 highlight, an intervention may help increase not only creative self-efficacy but also creative productions, thus suggesting that embodied creativity training can help participants become more confident in their creativity. Our results also partly echo Goodrich et al. (2020)'s study who conducted an intervention study on students' writing self-efficacy. Contrary to our results, their intervention showed significant enhancement of students' self-efficacy. Their study differs from ours on several points: they 1) had a bigger sample ($N = 79$), 2) focused on younger students (mean age = 11.2 years) and 3) had a very different design compared with ours: their data was collected over 13 weeks – whereas in our case the research lasted two years. Nonetheless, their results suggest that the link between self-efficacy and performance is complex: they reveal that girls and boys demonstrated similar self-efficacy, despite girls' higher text quality. As such, the question of self-efficacy perception seems to be an issue, as young students may not be able to correctly distinguish their self-efficacy from their performance.

Interestingly, despite our non-significant results on creative self-efficacy and self-efficacy, qualitative results reveal that participants appreciated experiencing creativity, even though they acknowledge that the experience may have been difficult. This is in line with previous evidence suggesting that emotions embedded with creativity are mixed, but that generally participants experience positive emotions (Audrin et al., 2020; Audrin & Capron-Puozzo,2020;). Moreover, our qualitative results suggest that participants felt that creative experience may help them learn better. This is in line with previous research highlighting the benefit of creativity on learning (e.g., Capron Puozzo, 2016; Puozzo Capron ,2013;).

The size of the sample studied constitutes an important shortcoming of this research. Indeed, a sample of this size limits quantitative analyzes. Our results however echo Meinel and colleagues (2018)'s absence of significant effect of intervention on creative self-efficacy. As Meinel and colleagues suggest, creative self-efficacy may be more stable across time and thus less sensitive to an intervention. Notably, the link between creative performance and creative self-efficacy may vary, depending on the measure of creativity (see Haase, Hoff, Hanel, & Innes-Ker, 2018 for a meta-analysis).

Another limitation is related to the measurement of creative self-efficacy. We followed most of Beghetto and Karwowski's (2017) recommendation to measure creative self-efficacy as we measured participants' perceptions of confidence and focused on key features of task performance, we did not have the future orientation in our questions as we asked participants "I am confident that I…" instead of "I am confident that I *will*". Future study should follow more strictly these guidelines in order to provided wider insights into creative self-efficacy beliefs, which could in turn enhance predictive power of creative self-efficacy beliefs on creativity performance. Another limitation related to the measurements might be related to the timing of the measurement: as they were taken close to each other, these measurements might have been too close to each other, which might have created a learning-effect.

Beghetto and Karwowski (2017) further encourage researchers to measure not only creative self-concept, but also creative metacognition. The concept of metacognition may present an interesting concept to relate to self-efficacy. Metacognition refers to a knowledge regarding one's cognitive activities, in a learning process (Veenman et al., 2006;). It thus refers to the knowledge that people have regarding which strategies they might use for learning or problem solving (Jaafar & Ayub, 2010). Kaufman & Beghetto (2013); extend this idea to creativity, thus proposing the concept of "creative metacognition" (CMC). They define this concept as "a special form of cognition that helps people monitor and develop their creative competence" (Kaufman & Beghetto, 2013, p. 155). More specifically, Kaufman and Beghetto claim that CMC entails a combination of knowledge about 1) the context and tasks, 2) the strategies regarding how to be creative and 3) themselves (such as recognizing one's creative strengths and weaknesses). We believe that future studies may benefit from integrating creative self-efficacy measurement with CMC. Another line of research concerns exploring the pedagogy of creativity as a possible avenue for the development of innovative teaching/learning procedures that are more in line with today's pupils' needs and expectations (Serres, 2013). As several research have highlighted, training creativity seem to have significant impact on creative performance, which is a skill crucial for the pupils of tomorrow. A second track lies in longitudinal research. Several studies highlight the impact of coaching creativity seen transversally (e.g., Garaigordobil ,2006;) or in the short term (Doron, 2016). It would be interesting to evaluate the impact of such training on the same cohort over a relatively long period. Finally, some studies have highlighted the importance of age as a limiting factor to creativity (Karwowski, 2016). A promising area of study would be to evaluate the impact of a pedagogy of creativity on different age groups.

4. Conclusion

Creativity is an important factor that may favor learning and academic achievement (Gajda, Karwowski, & Beghetto, 2017). In this research, we were interested in the importance of (creative) self-efficacy, and how (creative) self-efficacy may improve through an intervention designed to foster creativity. While no significant effect of intervention on (creative) self-efficacy was found, qualitative results suggested that the intervention helped students to feel better with the topic and to remember it better, few months after. This research makes highlights the importance of providing creative training designed to enhance the link between the perception of learning and that of being creative.

Author statement

The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tsc.2021.100966.

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