Review Article

Creativity as a Stepping Stone towards Developing Other Competencies in Classrooms

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Creativity, as a 21st-century skill, has gained more interest these past years and has become one of the key competencies to be implemented in classrooms. However, some studies highlight teachers' difficulties to integrate it in a classroom context. For instance, introducing creativity in overloaded school curricula may be a hindrance to developing it. Teachers have to implement other 21st-century competencies (the 4Cs) at the same time as well. These educational objectives can be considerable in terms of time and means for teachers and thus do not encourage them to develop these competencies. The purpose of this article is to present links, essentially theoretical, made by researchers between creativity and other 21st-century skills (e.g., critical thinking, metacognition, and collaboration). We considered that if creativity shares some characteristics with other competencies, it can be possible that, by applying only a teaching-for-creativity approach in classroom, we can also contribute to developing the other "C" as well. So choosing only creativity can be a way for teachers to develop their pupils' skills without falling behind in their curriculum. In this article, we will also discuss our hypothesis taking into account limits from teachers' classroom practices. Teachers' training, evaluation, and everyday practices will be considered.

1. Introduction

In France, the Bataclan and Nice terrorists attacks were by far the most terrible event that French people can report over the last decade. Shocking pictures and video footage of the attacks were everywhere on the internet and can be easily seen by everyone, even by youngsters. At this moment, one of the most raised topics was "how to explain the situation to children? How teachers can, in a proper way, talk about these events with the younger kids?" To answer these questions, the French government published on its website a list of advice to parents and teachers in a way to help them communicate the facts. The advice concerns attitudes towards children (listening to their fears, opinions) but also the need of clarifying the facts and warning them over rumors and manipulated information. Furthermore, some teachers chose to deal with the event by proposing drawing or writing activities in classrooms to allow children to express themselves.

In this context, more than ever, children may need some abilities to adapt themselves to the uncertain future. More specifically, developing new competencies is needed [1], allowing them to offer new solutions for a peaceful future. Creativity seems to be one of the core components of these new abilities and is considered as an asset for societal development [2]. Although creativity is widely recognized as an asset for society, it remains a fuzzy concept and there are many definitions of this competency in the literature [1].

For some authors, creativity is "a novelty that is useful" [3]; "the production of novel and useful ideas by an individual or small group of individual working together" [4]; or the ability to produce novel and adapted solutions in a specific context [5]. In these definitions, the focus is put on the produce and seem to lead on a general agreement of the nature of creativity [6]. For El-Murad and West [7], today most of the definitions of creativity combine the ideas of "novelty," "appropriateness," and "usefulness." In this article, we choose the present creativity as the process of having

original ideas that have value [8] and as an ability which can lead to major discoveries or simple creative production in everyday life [9].

The main objective of this article is to review the literature on creativity taking into account the other 21st-century skills. The P21's Framework for 21st-Century Learning was developed in order to present the skills and knowledge needed for students' success. This project, designed with the help of US teachers and business and educations experts, highlights various subjects such as the "content knowledge and 21st century themes" (e.g., sciences, arts, financial literacy, or global awareness), the "learning and innovation skills" (e.g., the 4C: creativity, critical thinking, communication, and collaboration), the "information, media, and technology skills" (e.g., working with the 21st-century technologies and innovations), and the "life and career skills" (e.g., social and emotional competencies to succeed in life and work environment). Currently, this framework is more and more used in order to change school curriculum in Europe and encourage teachers to develop these abilities in order to prepare children for an uncertain future and increase the chance of major discoveries and societal and economic prosperity [10]. So, in this context, we chose to focus our literature review based on this framework. We chose to focus on creativity because this ability is used by children in early stages of development and can be measured even in youngsters [11]. Indeed, children used it naturally to adapt themselves in everyday situations of their lives [9].

Our main hypothesis is that the introduction of creative practices in classroom can possibly lead to developing other competencies of pupils at the same time. In other words, we consider that working on creativity alone, if it is done in a meaningful way, may contribute to some extent to develop the other 21st-century skills as well (an all-in-one approach to the matter). We know that developing creative potential takes time and patience [9] but if teachers have a better understanding of the nature of creativity and its possible links with other important competencies, we hope that teachers will be reassured and integrate more easily creative teaching in class and so will aim to develop the other competencies of children as well.

For this purpose, we will present, first, a brief definition of creativity in educational settings and after that a review of the literature based mostly on the theatrical link between creativity and critical thinking, between creativity and metacognition, and, last, between creativity and collaboration skills. Finally, we will discuss these findings considering teachers' training and the nature of classroom activities.

2. Creativity in Education

Nowadays, the benefit of developing creativity in classrooms is widely recognized by education professionals [12]. Introducing creative teaching in classrooms can bring benefits such as developing children's imagination and increase the probability for major discoveries and economic development for the future [1]. Also, creativity is considered as an important component of personal well-being [13] and in a classroom context may develop curiosity, openness, and communicational abilities [14].

Actually, there are several theories of creativity and numerous variables that are involved in creative potential [11]. These numerous theories or variables can be confusing for teachers [12]. Indeed, the study shows that teachers have difficulty understanding and giving a clear definition of creativity despite the fact that they can understand the importance of creativity in education. So, in order to help teachers understand how to introduce creativity in classroom, we will first define the theoretical background of this concept through an approach that takes into account individual differences, the multivariate approach [15].

3. Creativity Multivariate Approach [9]

The multivariate approach defines four main components for creativity: a cognitive factor (e.g., intelligence or knowledge), a conative factor (e.g., personality or motivation), an emotional factor (the impact of emotional traits on creative potential), and an environmental factor (e.g., familial of school environments). In this article, we chose to put an emphasis essentially on the link between the 21st-century abilities and two factors: the cognitive and environmental ones. This choice is motivated by two considerations, first the cognitive factors can be trained in classroom through the school curricula and the environmental school factor can be changed through management made by teachers. The personality and emotional impact on creativity are needed but we considered the cognitive and environmental as a first objective for teachers considering existing evidence and techniques in the literature that can be introduced in everyday teaching. However, in order to help our lecturer to better understand the nature of creativity, we present all four components of the multivaried approach.

For the cognitive factors of the multivariate approach, there are many components whose impact on creativity can be studied. First, divergent thinking, consisting of the ability to produce many solutions from a situation [5], is an essential ability involved in creativity; next, there is the convergent thinking defined as the capacity to consider the demands of the environment and produce a unique and original solution based on several ideas. Convergent thinking involves the ability to associate different ideas, evaluate them, and combine them into a new, original production [16]. Also, Lubart et al. [5] specified other skills involved in creative potential such as the evaluation of ideas, the capacity to select the relevant ideas and to put aside the irrelevant ones or mental flexibility defined as the ability to consider an idea through different angles and also to deviate from one idea to consider another to propose creative solutions.

Conative factors have an impact on creativity. Some ways of behaving have been identified and characterized by creative individuals. Lubart and colleagues [5] cite several of them, including personality traits, cognitive styles, and motivation. Cropley [17] presented a list of common personality traits involved in creative potential of individual such as independence, openness to experience, flexibility, and tolerance of ambiguity [18, 19]. Concerning the creative

personality in youth, Callahan and Missett [20] were able to establish a number of characteristic traits of creative adolescents such as a rejection of social conformity; desire for independence; attraction for novelty; an important imagination taste for risk; and greater perseverance in the face of obstacles and ambiguous situations. Also, regarding the influence of motivation, Amabile [21] found that creativity is based on intrinsic motivation and children with extrinsic motivation tend to be more conformist.

Concerning the emotional factor of creativity, emotions have an impact on individual creativity [22]. Shaw [23] indicates various feelings involved in the "joy of creation" such as fascination, self-confidence, frustration, relief, excitement, and satisfaction. Also, Zenasni and Lubart [22] indicate that the emotional intensity (e.g., intense emotional state can enhance creative potential of artist), the nature of the creativity task (the relation between creativity and emotion may vary depending on the task), or the emotional traits of individual (e.g., the ability to identify emotions) modulates the effect of emotions on creativity.

Finally, the environmental factor of creativity refers to the familial environment (e.g., an open and nourishing environment where children can explore and share ideas) but also to the school environment [11]. The impact of the environment is crucial for developing creativity [2]. Indeed, it is easier to practice creativity when the circumstance allows it [11]. Craft [24] indicates that school environments provide children a frame for developing creativity by allowing them to ask questions, share opinions, and engage in critical and evaluative thinking practices. In a literature review, Davies et al. [25] also provide some examples of practices for developing creativity in school environment such as flexible use of space and time; working outside the classroom; respectful relationships between teachers and learners and nonprescriptive planning.

So aiming for creativity other than competency may be more natural to children and less difficult to introduce to them than other competency (e.g., critical thinking, metacognition, or cooperation working).

4. Children Creative Potential

The ability to produce novel ideas is referred to as the creative potential. Creative potential refers to the individual's possibilities taking into account the cognitive capacity, personality, motivation, and the environment [11]. Considering the development of creative potential, it can change over time and the potential will vary depending on the domain and the task [2].

Beghetto and Kaufman [9] proposed four levels of creativity that describe individual's creative productions such as "Big C" level which refers to the eminent creative person (e.g., Einstein) and "Pro C" individuals expert in their fields (e.g., a scientist, a painter). In everyday life, the authors distinguished two levels: "little-c" considered as creative by their peers (e.g., winning a school contest) and "mini-c" individuals who use creativity for learning (e.g., learning insights). Children show mostly "mini-c" or "little-c" [9]. The benefits of "mini-c" or "little-c" activities in education

are numerous [26], including meaningful learning, reducing stress, or a better engagement in learning activities.

In an ecological context and considering the variations of the multivariate approach factors in everyday situations, we consider that the main topic regarding creativity in classroom is not student's performance but mainly their ability to know what is creativity and how to use it in a meaningful way. We saw previously that the school environment can promote the use of creativity and teach children about creativity. Also, a common distinction is made between "teaching creatively" and "teaching creativity" [24]. Teaching creatively refers to the ability of the teacher to make learning more interesting by using creative approaches; teaching creativity is defined as teaching methods with the purpose of developing students' creative thinking [27]. The N.A.C.C.C.E report [28] indicates a close relationship between these terms and also that teachers' creative abilities are engaged when teaching for creativity practices. Hence, we chose to develop this article in terms of a "teaching for creativity" perspective considering that it can inspire practices of teaching creatively as well.

5. Teachers Role in Promoting Creativity

For promoting creativity, the role of teachers is crucial [29]. Indeed, teachers' beliefs towards creativity or students abilities may affect the development of their creativity [9]. Teacher's impact on the development of creative potential is known and their attitudes towards children potential are important (e.g., high expectations, support, open attitude, and tolerance to ambiguity) [30]. However, despite the essential role of teachers and the numerous benefit of creative teaching, creativity is not much integrated in classroom curriculum.

Cachia et al. [12] conducted research on teacher's perception of creativity and the teaching practices that enhance creativity and innovation in classroom. In their research, they gathered the opinion of (mostly) primary and secondary school teachers from 37 countries in the European Union. To collect their data, they used various means such as interviews with experts in the educational field, analyses of 1200 curricula documents, and online surveys. Results indicate that even if teaching for creativity can be mentioned in school curricula from many countries, it does not mean that schools are developing creative practices. Also, they highlight the fact that teachers do not have a clear understanding on how should creativity be defined or how it should be introduced in classrooms (as learning or assessment), even though teachers recognized the importance and interest of teaching for creativity.

Sternberg [1] provided a brief historical overview of the development of creativity in the research field and in education. Since Dewey's [31] or Guilford's [32] argument for creativity until today, education does not seem to have significantly changed. In fact, Braund and Campbell [33] found that curriculum and assessment goals or time pressurized teachers create a difficult climate to introduce creative practices in classrooms. Also, creative thinking cannot be taught by "showing slides and talking about theory" [34]. It needs specific activities that can be domain general or domain

specific. Beghetto and Kaufman [9] are well aware of teacher's fears and to reassure them, they highlight the fact that there are moments and contexts for creativity.

6. The 21st-Century Skills

Binkley et al. [10] suggest a list of the 21st-century skills in order to help teachers and educators to implement it in classroom context. They divided the "learning and innovation skills" from the P21 Framework into groups. So creativity, critical thinking, and metacognition (learn to learn) are considered as "ways of thinking" and communication and collaboration as "way of working." In summary, creativity is a part of the 21st-century skills, alongside with critical thinking, metacognition, communication, and collaborative skills [35]. Communication skill, as defined by the P21 Framework, is the ability to use oral, written, and nonverbal skills to share thoughts and ideas in a wide range of situations. Felder and Brent [36] defined collaboration learning as a group of individuals (or students) working in teams under conditions where members of the group will be responsible for the content of their work and are willing to work together. Also, Ras et al. [37] defined collaborative problem solving as an ability to address problems in a collaborative setting. Members of the group will need to exchange knowledge and strategies to fulfill their mission.

Bensley [38] described critical thinking as a multidimensional construct with skills like decision making or problem solving. There are various definitions of critical thinking skills but a consensus has been reached over its definition [39]. Also, from one author to another, it is possible to observe the absence or presence of certain subskills. These subskills include observing the different facets of a problem [40]; analyzing arguments, evidence, and beliefs [39, 41, 42]; producing inferences [39, 40]; evaluating arguments [39, 43]; and making decisions [40, 41, 43]. According to the authors considered, it is possible to observe that the definitions of cognitive abilities may be accompanied by dispositions [44]. The critical thinker dispositions were for the most part considered in a philosophical context although some of them could be used in the cognitive sciences field. Among the frequently observed dispositions in the literature, some are frequently highlighted [39, 41, 42] such as curiosity, openness, and flexibility in considering the opinions of others, valorization of alternative opinions, and the ability to reconsider its opinion.

Finally, for Sanz de Acedo Lizarraga and Sanz de Acedo Baquedano [45], metacognition means the knowledge of cognition and the regulation of cognition and action. Flavell [46] defined metacognition as the knowledge that individuals have of their proper cognitive process and their products. According to Flavell [46], metacognition is presented through three phenomena: metacognitive knowledge, metacognitive experiences, and metacognitive skills [47]. These researchers present metacognitive knowledge of person, task, and strategy; metacognitive experiences as a range of feelings (perception of difficulties, satisfactions, or confidence) and judgements or estimation of effort or quality of learning; metacognition skills as the use of strategies in order to monitor cognition.

Hence, teachers need not only to teach about creativity in the classroom but also to implement other competencies in the same curriculum at the same time, which can put them in a stressful position. Now, we are going to present the theatrical elements of the literature that indicates links between these skills. Also, we choose not to develop the communication skills and focus mostly on the thinking skills and the collaborative way of working. This choice is motivated by the fact that the communication skills can be developed alongside the other competencies. For example, during the process of problem solving, pupils can share thoughts, ideas, and their points of view on their task, which can be seen as collaborative and critical thinking tasks where pupils are using their communication skills. Also, the use of communication skills depends on children's literacy which is already more developed in the classroom than the other competencies.

7. Creativity and Critical Thinking

Creative and critical thinking are two competencies that gained more and more attention these past years, especially, since the need to develop information and communication technologies in school. In fact, the digital revolution brings new problematics for education, notably, the impact of new technologies mean frequent changes in everyday life and the need for individuals to adapt to these situations. Also, the use of internet by children means that they need to select information from numerous sources and know how to use the information in a useful way.

Critical thinking has been defined in a philosophical and a psychological way by many authors [48]. Because of its numerous definitions, it can be considered as a fuzzy concept [48]. In fact, in a psychological point of view, researchers focus mostly on the cognitive processes involved during the critical thinking procedure whereas philosophers are interested in the value of the critical arguments [49]. The cognitive perspective implies various processes that compose the critical thinking process [49] and that can be observed in an educational context. Bloom's taxonomy of educational objectives [50] organizes instructional mental activities depending on their difficulty level in a classroom context (e.g., going from basic to higher order mental operations). For high-order level skills, Bloom [50] refers to analysis, the ability to organize and compare information, synthesis, gathering together information and evaluation, and making judgements on information.

These mental operations can be observed in the literature on creativity. Cropley [17] defined nine conditions where teachers can develop their pupils' creativity. For example, he advises teacher to let children make their own judgement and evaluate their creative products and by providing them more time for self-evaluation. The main reason lies in the fact that in this way pupils have more time to elaborate, formulate, and adjust their ideas and become more autonomous, a quality needed for creativity to develop. In fact, by being

autonomous, children construct their own idea of what they want and make and are more tolerant to ambiguity without strict norms that can lead to noncreative productions [51]. Also, by allowing children to ask more questions in the classroom, teachers can guide them to explore the possible answers to their questions alone or with their classmates and lead children to develop more flexibility, collaboration, and a better sense of self-evaluation. Also, mental flexibility is considered as an essential asset for living in the 21st century [51] and as an essential part in creative thinking [11]. As we defined it earlier, cognitive flexibility is essential to find various solutions to one problem or considering one problem through different angles [52]. Additionally, for creative convergent thinking, the ability to evaluate various ideas and choose the more appropriate one (make judgements), critical thinking is needed [11] and some research suggested that critical thinking implicates better judgements [53]. Finally, Dwyer et al. [48] presented critical thinking as a skill that should be more highlighted in educational setting. In fact, they argued that children should be trained to use more their critical thinking abilities in real-world problem in order to become more adaptable to the rapid development of the 21st century.

Some articles mentioned also the link between creative personality and critical thinking. For instance, Bailin et al. [54] considered that critical thinking in primary schools promotes the development of an open-mind. As well, Sternberg [55] described a critical thinker as someone who is open-minded, understands various points of view, and is flexible. Florea and Hurjui [43] exposed the same idea, considering that for developing critical thinking children need to have a tolerant mind.

Finally, considering the classroom context, Blamires and Peterson [56] present various ways of assessing creativity. In the assessment for learning techniques, some strategies to help teachers implement creativity in the classroom involve "questioning, exploring ideas, and having various options or reflecting critically on ideas, actions, and outcomes." Florea and Hurjui [43] defined critical skills as a way of solving problems by "verifying, evaluating, and choosing the right answer to a given task and reasoned rejection of other alternatives solutions." Also, Craft [24] recommends techniques for developing creativity in the classroom. One of them refers to the need for teachers to establish link between concepts, make children reflect on possibilities and solutions for one problem, and explore and think critically over their ideas.

So, considering these researchers, we argue that creativity and critical thinking are needed and also that these two skills are linked. We cannot assume based on the literature that developing one of them (creativity) can be sufficient for developing the other (critical thinking). However, with the theatrical background presented, it can be possible to consider that they are present alongside in some situations and share some processes, and so maybe using one can contribute to developing, in a certain way, the other.

8. Creativity and Metacognition

Metacognition skills can develop at the same time as creativity. Indeed, Sanz de Acedo Lizarraga and Sanz de Acedo Baquedano [45] argue that creative thinking can be considered as a part of metacognitive processes because a person has to monitor his thinking skills during the production of a new and useful idea. Also, during the creative process, an individual must check his or her strategies and adjust them if needed in order to increase creative output. Sanz de Acedo Lizarraga and Sanz de Acedo Baquedano [45] referred to Jausovec [57] who described metacognition as an ability needed mostly for convergent thinking which is part of creative problem solving. Sanz de Acedo Lizarraga and Sanz de Acedo Baquedano [45] explained that the link between creativity and metacognition is less explored because of the difficulty to assess it; this is mostly due to the measure of the incubation stage of creative process, a stage where ideas are associated unconsciously. Sanz de Acedo Lizarraga and Sanz de Acedo Baquedano [45] conducted a study to measure the link between creativity and metacognition. To assess it, they used a divergent thinking task combined with a metacognition scale for creativity. This scale measures the knowledge participants had on their thinking process or the task and their regulation of cognition that refers to the regulation of their behavior during the creative task. The result of the study shows a positive correlation between total creative potential and total creative metacognition and also presents metacognition as a predictor of total creative potential ($r = .66$, the coefficient of determination (R^2) indicates that metacognition explained 45% of variance of total creative potential). So this research contributes to showing a positive link between creativity and metacognition and emphasize the importance of considering metacognition alongside with creativity.

In the classroom context, other authors, like Besançon and Lubart [11], recommend that, in order to develop creative thinking, teachers should encourage children's self-evaluation of their ideas and improvise courses with the purpose of allowing pupils to construct and develop their knowledge and use metacognitive reflection. Also, Sternberg [58] found that metacognition abilities were linked to creative problem solving. In the arts, a high level of metacognition is correlated with a creative production and children's play (a determinant activity for developing children creativity) increases the level of children's metacognition.

Finally, Beghetto and Kaufman [9] argue that children need to know when to be creative. Indeed, these authors highlight the fact that creativity is often seen as totally beneficial. Although this consideration is true regarding the fact that creativity can contribute to innovation and adaptation, there may be negative impact of using creativity in some circumstances. These negative impacts include personal and social risk. Beghetto and Kaufman [9] defined personal risk as wasting time, bothering others, and being ignored or misunderstood. In the classroom context, creativity can appear anytime during the lesson and bring as well these negatives impacts. Considering these effects, Kaufman and Beghetto [26] propose the concept of creative metacognition

(CMC), defined closely to Flavell's one [46]. CMC is seen as a combination of creative knowledge about ourselves (e.g., creative strength and weakness, past experiences) and knowledge about the context in which creativity can occur (in general or in a specific domain). Thus, mastering the concept of creative metacognition in a teaching context can be an effective way to develop at the same time creativity and metacognition.

9. Creativity and Collaboration

Finally, collaboration refers at the same time to the 21st-century skills but also to a method sometimes used in classroom [59]. This skill presents an interest mostly because collaborative work is a way of teaching generally appreciated by pupils helping them to find different solutions to a new problem, to express different opinions, and to be more engaged in tasks [60]. Despite the fact that collaboration is often cited as an interesting skill for developing creativity, to our knowledge, a few studies exist that highlight the link between these competencies.

Navarro-Pablo and Gallardo-Saborido [61] presented some benefit of cooperative work, such as deeper understanding of the task and development of interpersonal skills or critical thinking skills. Slavin [59] mentions the fact that collaborative learning may increase cognitive abilities such as their learning abilities and lead to better performance on the task. Lucas et al. [51] add that creativity can develop better social and emotional skills through the practice of collaboration. Yates and Twig [62] review practice enhancing creativity potential in a classroom context. One of them refers to the classroom environment and more specifically to children's communication skills. The authors argue that better communication between children will lead to the production of new ideas and solving problems. Finally, Besançon and Lubart [11] recommend that teachers in order to develop creativity offer the possibility of pupils to work together and to encourage students to help each other as much as possible.

Collaboration skills are almost always considered as interesting skills to develop creativity. However, taking into account the French education system, the more children are growing up, the less they have the possibility of working together and also French teachers rarely used collaboration techniques (nearly 37% of them) [63]. The main reason concerns the way assessments are made in the classroom and the way the tasks were assigned. For example, although children are asked to work together, we cannot be sure that they fully understand the purpose of this way of working and also do not think that collaboration means only working with at least another classmate. Hence, we cannot be sure that children understand the cognitive and social benefits of collaboration and that the practice of collaboration will develop any skills.

10. Discussion

Through this literature review, some limits about the findings can be highlighted. Indeed, most of the studies presented are the theoretical points of view of researchers who have worked on creativity, critical thinking, metacognition, or cooperation. Few empirical evidences (to our knowledge) about the link between creativity and other skills exist and are drawn from class situations. Also, we know that although these variables can be correlated, we cannot explain a causal relationship between them. So we do not really know which one is the cause and the effect. This is one of the limitations of the actual literature. We strongly recommend that teachers try to introduce creativity into their classroom to see if there are other effects on other skills but we insist that our recommendations are based on theoretical findings mostly. As well, even though these variables will have an effect on another, we cannot know to what extent and predict the strength of these effects. Thus, the need to conduct research on the issue is more than highlighted. This lack of evidence has prompted us to choose only numerous theoretical evidences in order to encourage other researchers to go deeper into this subject and so consider studying in the classes the link between the 21st-century skills and their causal relationship. Also, this literature review made it possible to elicit the following reflection: in the educational context, it is frequent to target studies working on a competence itself or sometimes two but can we really consider the school environment as one or two variables at a time? The necessity to go out of our laboratories and study in classrooms the everyday life of pupils and their teachers, who alternate or combine situations involving critical thinking, creativity, cooperation, or metacognition, seems paramount. It may be also interesting to study the cognition of teachers in classroom situations and observe the means by which they try to introduce practices and see which ones succeed and which ones fail. For instance, we can observe the way they integrate some creative moments in the classroom, the way they give feedback to their pupils, or why some practices are preferred by teachers over others. We should also see if teachers tend to implement one competency over the others and why? If so, it does not matter which competency is chosen; what matters is the optimization of the skills to develop the others.

About the teachers practices, some limits can be highlighted too. First, Cachia et al.'s [12] study offers another interesting result; teachers who have the greatest interest in creativity or innovation are also the ones with many years of experience in education. This result may be surprising considering Sternberg [1] point of view on teachers training. In fact, Sternberg [1] proposed to change teacher's training for the following reason: the former teachers have become the trainers of the new ones and so the traditional way (e.g., summative assessment, passive learning) of teaching persists, which is not useful for the development of creative practice or other competencies. So, considering these opposite findings and the fact that new generations of teachers, those born at the end of the 20th century (the 90s) and having grown up with the problems of the 21st century, can be less interested in innovation than the older ones, new research about teachers' practices are needed. The impact of initial teacher training needs to be observed and measured. It will be interesting to see if, as Sternberg says, new teachers will continue to adopt a traditional way of teaching.

Also, even if the new or experienced teachers learn about 21st century competencies, how can we be sure that they will become efficient in transmitting these 21st century skills? To answer this question, first, it can be useful that researchers who work on 21st competencies combined their effort with teacher trainers, to integrate in their curriculum training on competencies and measure the impact of this training before thinking of bringing it into classrooms.

Another interesting topic concerns the way of assessing those competencies in classroom contexts and curriculum. First, adding those skills in school curricula will involve the need for teachers to assess the progress of their student and the mastery of these skills. The traditional way of assessing knowledge, the summative assessment, the classical way of assessing by rating student performance, is probably not the optimal way of rating these skills. Mainly, summative assessment is related to significant deficiencies such as superficial learning and the failure of transferring learning over situations. However, formative assessment, assessment by feedback with the aim of helping student progress, is considered as a stimulating practice for pupils' imagination, allowing an open dialogue between teachers and students and more engagement in learning [56]. Also, regarding assessments, most of them, at least in the French school system, are based on individual ones rather than group tasks; we can assume that this way of assessment is preferred because it seems to be easier for teachers. So the need for change in assessment is crucial to introduce 21st skills in classrooms.

To help answer a few of these issues, we will follow new graduate French students from their last year in teachers' training academy to their first step as primary teachers and follow them for the next three years. Half of them will study the 4C competencies presented in this review. Students will study these skills through online materials, which will also be used in class by their trainers. These online materials aim to define skills in order to help students to better understand and use them. These competencies will also be discussed during their training to help them reflect on their practices and consider ways to implement these skills in classrooms. Their 4C competencies will be measured quantitatively (using tests) and qualitatively (observation made in classroom, practice follow-up notebook) during each year to see the change of teachers and pupils practices. Also, teachers' efficiency in their practices will be assessed and analyzed through filming everyday teaching class and collecting some of their teaching materials and through interviews of their perception of their training and their practices.

With this protocol, we will see if a change in teacher's training will be effective to implement the 4C and also to obtain some directions to understand the classroom context for developing in an effective way the 21st-century competencies. We will also have a better insight of everyday class situations and the problematics that young teachers encounter. Finally, we will analyze our data based on (a) the links between these variables but also and above all to study (b) the causes and the effects of the introduction of these variables in classrooms.

11. Conclusion

The purpose of this review was to provide teachers with some arguments that creativity is linked to the other 21st-century competencies. We hope that this article will provide insights and ideas for educators and will encourage them to explore the impact of implement competencies at the same time or through the use of one skill to see the effects on the others ones.

Also, we would like to emphasize that, in the literature, there are few articles on these topics and even less empirical ones. The report is the same regarding the use of the 4C and ICT (Information and Communication Technology). We hope that, in the future, more ecological research will focus on the reality of the classroom context and see how research-validated techniques can facilitate the daily issues that teachers encounter.
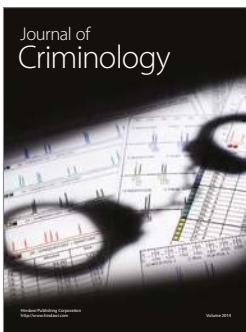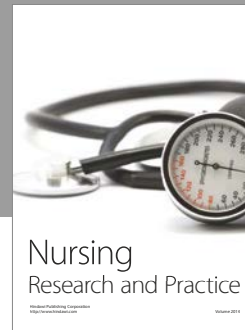
Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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