

## 19. Researching, measuring and teaching creativity and innovation: a strategy for the future

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### Abstract

*The Institute of Creativity and Educational Innovations (INCIE) has developed an Educational Model for Creative Development (PECEI) in order to promote creativity and innovation, and has proven its worth among schoolchildren. It is a strategic model that relates to the individual (development of a creative and entrepreneurship spirit), to the process (of innovation), to the product, and to context. This model has been developed based on the indicators that the most relevant authors in the field have traditionally considered as those that define innovation and a creative person. We now want to provide the model with a solid empirical basis in order to expand it, which will allow empirical validation and, if necessary, the re-elaboration of the model in order to use it with the general population. We have, therefore, proceeded to analyse the bibliographical corpus of all the authors who in recent years have published papers on indicators of creativity. Based on this information, we have defined a series of basic factors, which have served as a basis for a working definition of creativity as a reference for producing a measuring instrument (questionnaire) within the traditional theoretical structure of the elaboration of norm-referenced tests. This paper outlines the main aspects covered by the instrument and the future steps to be taken in order to improve the instrument.*

## Introduction

Human beings need to innovate and be creative within their surroundings in order to live and progress. Creativity is a trait all human beings possess to a greater or lesser extent. We understand creativity and the capacity to innovate as attainable skills, as strategies for the future that need to be stimulated by education in order for individuals to be able to meet the challenges that arise nowadays in the different domains of reality. The research and measurement of creativity demands the introduction of changes: new practices in teaching; changes in objectives, curriculum, methods, etc. In this way, teaching, measuring and research on creativity become a strategy for the future. The Institute of Creativity and Educational Innovations has developed an Educational Model for Creative Development (PECEI) in order to promote creativity and innovation. The present article shows some of the aspects that these new tools pertain to measure.

## Creativity and education

Creativity is a human characteristic, archetypal of the 'being that ponders' that thinks, that senses the relation of cause and effect. Humans are capable of imagining, formulating hypotheses, planning and carrying out 'something new and worthy,' establishing objectives and putting in order one's priorities. To achieve their purposes, humans frequently have to walk down new roads, give birth to what has never been done: create. Humans create by giving answers adapted to a changing environment by establishing scenarios, strategies for the future, and by designing, making art, or finding a solution to one's problems.

In order to carry out innovation, our accumulated experience is not enough. Humans innovate when they perceive a new necessity and they do so by reviewing and combining existing knowledge in a process of interaction with their surroundings, searching for the best solution. From this perspective we may interpret innovation as a learning process whose basic resource and main result is knowledge. It is, however, a complex process, which feeds itself both with tacit knowledge and with explicit and specialised knowledge, and which can be affected by a diversity of factors. Some of these are internal and individual (sensitivity, flexibility, motivation, proactivity, ability to analyse, etc.), whereas others are present in the environment (education, personal interactions, and social context).

Education and creativity are manifestations of integral human development, but they are different. Education is a process that aims to go beyond socialisation (to be like others) and to make the educated person a unique individual. It is precisely through this function that education has the possibility of promoting creativity and innovation.

Torrance (1976), one of the great theorists of creativity, stated back in 1977, that there are many reasons to think of the education of the future in creative terms. There is a fast pace of change: today's children will live as adults in a world profoundly different from the one we know now. Many will work in jobs that do not yet exist and that will require abilities, skills, attitudes, and information that we cannot yet imagine. In this new society, these changes will require high levels of inventiveness and creativity, and knowledge will be the basic wealth.

When we talk of the human beings and our creative development we have to start with our condition as *a being that learns*. This provides us with great freedom of action, since our survival is not determined by the innate pressure of instinctive actions. Our learning capacity and the guiding influence of the environment are included in the biological development plan of the species, which determines a very long period of immaturity and a notable retention of features of early childhood.

We are basically animals that learn: our cerebral immaturity and long infancy allow for cultural learning or, in other words, the acquisition of ways of behaviour through education. Educability is found within the genetic code as a possibility and requires that the process takes place through social mediation (García Carrasco, García del Dujo, 2001). Likewise, the educability of the human being is the result of evolutionary processes. It is not a static ability, but it is defined in terms of a process; that is to say, the level of educability depends on the quantity and quality of the individual's learning (Castillejo Brull, 1983). This great potential, determined by the acquisition of knowledge, educability and our biological indeterminacy, opens up the possibility of being creative and of developing this potentiality through education.

To teach creativity we need to have a model based on the indicators that define innovation and the creative person. This will allow the structuring of programs that define the process of creative teaching-learning. It is important, however, to note that all models require evaluation and measurement in order to guarantee their pertinence and to allow for the constant improvement of the educational process. We also need to know what the implications of measuring creativity are for educational processes, since creativity introduces substantial changes in the educational process; not only for the teacher but also for the students.

### ***The person and the teacher in the PECEI model***

PECEI is a model focused on the subject and the process. The model assumes that creativity involves the development of a set of attitudes and thinking skills that permit improving our environment by applying our learning and experience in order to obtain original and suitable responses. Creativity increases our intellectual potential and

leads to self-realisation and satisfaction. PECEI is a model for teaching creativity, that includes also evaluative aspects, thus, a model with a measurement tool. The model, once developed, will permit to justify the establishment of criteria for judging the educational quality of creativity in its most important dimensions.

In relation to the individual, our model defines creativity by divergent thinking, originality, flexibility, independence, the motivation to succeed, sensitivity, the capacity for inventiveness, imagination, etc. Creativity is defined by the capacity to change 'the patterns of perception' established by experience, in order to develop 'patterns of action' (De Bono, 1988). The development of creative attitudes is crucial for this to appear, in fact, numerous investigations have found constant associations between creativity and attitude (Nickerson, Perkins and Smith, 1987). Moreover, students must be freed from the limitations and obstacles which impede creative behaviour: fear of making mistakes, fear of failure, lack of motivation, laziness, negativity, dependence on the group, insecurity, etc. Other potentialities must also be developed such as: self-reference, belief in oneself (self-confidence), proactivity, and knowing how to put off gratification, overcome frustration and persevere toward achievement. Also necessary are imagination, curiosity, interest, a critical sense, the ability to assume collective thought, etc. These characteristics, of a personal nature, are fundamental to creativity and are also the basis of entrepreneurship (Castells and Vilaseca, 2007).

Regarding attitudes, the creative attitude provides a multiplicity of perspectives and the possibility of 'seeing again'. The creative attitude is opposed to routines, continuity or the same way of understanding causes and effects. It demands freedom from narrow limitations, the ability to go beyond and leave behind automatic reasoning in order to appreciate other types of relationships. Creative attitude involves playing with metaphors when describing what exists, and revising the paradigms we use to understand reality, opening the door to imaginative responses.

Thus, the first step is to promote (at a cognitive level) the development of new beliefs and opinions. That is to say, it is necessary to develop new patterns of perception that allow us to free ourselves from previous judgements (prejudices). Beliefs (preconceptions gathered from the information that the person has about something) with sufficient reinforcement generate attitudes, and attitudes precede action. One must take into account the three fundamental components of attitude (cognitive, emotional and behavioural). These three components are not necessarily linked: people do not always act as they think and feel. For this reason, in order to indicate a change in attitude, one must take into account the guiding influences of the individual, such as his or her expectations..

Based on these assumptions, the teacher of creative education, as a starting point, must not confuse education with 'manufacturing.' The educator cannot predict the nature of his or her work, since the teaching practice will always be 'probabilistic' in the sense that there is certain likelihood of certain teaching practices to produce certain outcomes, but there is no guarantee. The 'resistance' of the students to engage in the educational situation must be taken into account, and it must be understood as a call to rework educational action, based on the right of the individual being educated to be recognised as a 'self'. This also implies that the educator assumes the role of authentic authority (not authoritarian) from an asymmetrical standpoint. The students will grant authority to the teacher by recognising his or hers qualification, knowledge and know-how.

The educator cannot abandon authority, but neither can he/she cling to it as a privilege and confuse education with training and subjection. This would favour convergent thinking, submission, and would impede the development of creative ability. Thus, the education of creativity is not possible without first creating an educative environment that permits original contributions and divergent thinking to flourish.

Designing creative educational spaces is necessary in order to encourage divergent attitudes that allow individuals to dare to think for themselves. An environment of freedom helps individuals liberate themselves from their burdens, emboldened by the security that authentic authority provides. Routine activities, which move through the trite arriving at answers that are known beforehand as the only possible ones, have no place in creative learning.

### ***Process in the PECEI model***

The process is understood here as a tool of thought, which can be employed deliberately to produce a result. The result (the creative product) can only be valued and admired, but the creative process (like any process) can be taught, learned, and practiced. That is to say, it can be improved with training.

The creative process requires inventiveness: having an idea, a hypothesis, a project, and being able to develop it. It demands the ability to use ideas outside of the judgement system: because judgement keeps us in the channels of experience, making the process of creation impossible. Ideas have to manifest, be developed, tested, evaluated and modified. Also necessary is the ability to escape the typical dominant idea in order to be able to attend to the influx of new ideas. Stimulation, intuition, direction, and perseverance are necessary to give incentive to the effort of achieving, because in this way only is it possible to finally overcome the environment and its resistance.

During the process, divergent thinking is essential, as is critical thinking, which defines the direction when confronted with multiple options. Moreover, critical thinking generates sub-objectives by looking for the most parsimonious. Critical thinking contributes to the improvement of the creative product. Critical thinking may not be creative, but the development of the creative process cannot be but critical.

For its implementation the creative process can use diverse strategies, which in turn can improve the process itself. Among the most common strategies are brainstorming, analogy, imaginative transformations, enumerating attributes, and liberation from the dominant idea.

Finally, it is necessary to examine the measurement of creativity for educational purposes, since evaluation is an integral part of the model for teaching creativity.

## **What aspects of creativity are being measured?**

Measuring creativity in itself is a challenge because it tries to measure, beyond that which is established, it tries to measure that which is divergent. In fact, the creation of measuring instruments to identify the creative abilities that permit the individual to bring to life his or hers creative disposition, is the main problem facing those who want to establish, with precision, educational models and models to evaluate creativity.

Based in different theories, numerous tests have been produced. We will briefly review those that have obtained general recognition.

Since the 1950s the great theorists of creativity (Guilford, Torrance, Getzels and Jackson, Wallach and Kogan, Barron, Marín, among others) have worked to evaluate and measure creativity.

To measure creativity, we started with the different categories that we want to measure. In the first group of test types we have Guilford's tests of creative production (divergent production, fluency, flexibility, originality, convergent production, etc.) and association tests, creative aptitude tests or Torrance's tests of creativity. What underlines all of these is that they measure aspects of aptitude, generally through the answers of individuals to certain closed or open stimuli (graphic, verbal, etc.) that are presented to them.

Secondly, we have tests based on the creative personality, which try to evaluate dimensions of the personality (attitudinal, motivational or behavioural characteristics, interests, etc.) typical of creative individuals. Elements evaluated include: confidence in one's own ideas; fantasy; desire for novelty and innovation; willingness to face risks; complexity of thought; independence; security; self-affirmation; curiosity, etc.

A third group would be formed by the so-called inventory tests, which compare the evolutionary development patterns and the biographical behaviour of individuals. For example, there are autobiographical inventories and behavioural inventories.

In a fourth group would be the project tests (Tat, Rorschach). In the Rorschach test statistical frequency determines if the answer is original or not.

In a fifth group would be performance tests, divided in two subgroups: tests of artistic abilities, which try to evaluate the capacity for appreciating and/or producing an artistic form, and psychometric tests of creative performance focused on evaluating the creative performance of individuals, their productions. In general, we can distinguish two main tendencies: there are tests that measure creativity through the ability to produce creative 'answers' when confronted with a specific stimulus, and those that measure characteristics (motivational, attitudinal, behavioural, etc.) that form the basis of the creative personality.

In the Institute of Creativity we are in the development phase of creating a measuring instrument, the TSPC.

### *What aspects are measured by the TSPC?*

The approach adopted by the PECEI (Educational Program for the Development of Creativity and Innovation) model is to consider creativity as an acquirable skill, although some individuals possess this quality naturally. We understand creativity as a skill with which students are eventually able to find new ways of seeing and doing things and wager solutions to different problems posed.

PECEI has, as a point of departure, the basic indicators of creativity gathered from the bibliographical index of the most representative authors<sup>1</sup>.

In order to evaluate creativity we concentrate on measuring the characteristics of the creative person through the perceptions these individuals have of themselves in relation to the indicators of creativity that are most relevant regarding *mental* and *behavioural* aspects: what they think and what they do.

The objective is to create an instrument for the evaluation of creativity, using a series of indicators derived from a working definition of creativity. The basic indicators are categorised in terms of the subject, the process and the context.

We understand as an indicator a meaningful variable with a normative character. More specifically, we understand as an indicator of creativity (in our case) a variable

<sup>1</sup> Bibliographical corpus prepared from Valiente Berna, J. (2009); Martín Ibañez, R. (1996) 'Indicators of Creativity', in *Creativity: Assessment, Evaluation and Investigation*, Madrid. UNEDS de la Torre (2006) 'Reference Points and Indicators of Creativity', Torre and Morales (coord.) *Understanding and Evaluating Creativity: A resource for improving the quality of teaching*. Málaga. Aljibe.

that gathers traits characteristic of the creative person, the manifestations of individual subjects and who they perceive to be meaningful references in their environment.

We also pay attention to the significant references of their environment and if they consider themselves creative or not; with special attention given, in reference to the product, to attributes of originality and suitability. We will afterwards complete this evaluation with behavioural and biographical inventories of those identified as creative through the questionnaire.

These indicators will permit us, on the one hand, to assess creative realities, and on the other, to implement objectives to be achieved in the education of creativity.

### ***Steps followed in the elaboration***

We have proceeded to analyse the bibliographical corpus of the authors, who, in recent years, have published papers on indicators of creativity, by carrying out a meta-analysis of what already exists. The most commonly used indicators we found included sensitivity, in general, and when faced with a problem. This is defined as knowing how to discover what is beyond the established information or insufficiently explained; it refers to the ability to detect problems and anticipate consequences. It involves fluency and productivity in the sense of not being content with the first results and continuing seeking alternatives. For this, it is crucial the ability to formulate new hypotheses and new approaches, to have mental flexibility, as opposed to rigidity and repetition and the capacity to change perspectives, having a unique character.

Although these are the most common and most used indicators, there are others such as: self-confidence; capacity for synthesis, association, and analysis; the ability to redefine resources; imagination; desire for achievement; organisation; communication; proactivity; and the searching for experiences.

Based on this information, we have defined a series of basic factors, which have served as the reference point for developing a measuring instrument (questionnaire) within the traditional theoretical structure of the construction of norm-referenced tests.

The questionnaire was first pilot tested online with one hundred individuals in order to assess its adequacy, the comprehension of the questions and the coherence of the answers, and to obtain an initial evaluation regarding the reliability of the instrument (internal consistency) and initial evidence of its validity. We have extracted a series of factors that permit us the first working approximation of creativity without a consensual definition.

Once the quality of the pilot test was evaluated, we drew up a definitive measurement tool to be used online for a survey of creative professionals (art, publicity, business, architecture, etc.) and the general population.

The results of this survey will be analysed using classical statistics and complex mathematical models. Afterwards, we will try to establish a model of measurement by setting up diverse scales in various dimensions and components, in order to be able to collect the different aspects of creativity, as a single form of creativity does not exist.

Subsequently, and from a perspective of (quantitative/qualitative) methodological complementarity, we will try to complete the definitive design of the instrument and its validation based on ethnographic strategies, which allow us to identify key biographical elements of the concept of creativity as it is revealed by people identified as creative. Once determined the pertinence of the measuring instrument from the research evidence, we will be able to lay the foundations of educational models for creative development with a general and/or sectorised application and to develop experiments in educational contexts to study the educational potential of the model.

## Conclusions

Creativity is a trait which all humans possess to a greater or lesser extent, although it needs to be cultivated; experience leads us to automated responses and we stop being creative.

Teaching creativity is a strategy for the future because humans need, more and more, to be creative in order to face the challenges that arise in the different domains of reality. The education of creativity is a strategy for the future because we live in a changing society. In the same way, investigating and measuring creativity is a strategy for the future because evaluation, which forms part of the educational programs of creative development, introduces analysis and provides information for educational improvement.

Education and the measurement of creativity require starting from models, which justify the establishment of educational criteria for quality in its basic dimensions. The measurement of creativity has implications for the processes of education in relation to the student, the teacher and the process itself.

Education is a double-edged sword that can be used to either cultivate or stifle creativity. The teacher is the fundamental reference point in the school: their role is of prime importance in promoting creativity in his students.

The problem of the evaluation of creativity is tied to that of its definition, the indicators which allow for its measurement and the instruments of measurement. Although the scientific production in this field is substantial, unanimity does exist regarding neither the concept of creativity nor its measurement.

The measuring instrument TSPC, in the development phase at the Institute of Creativity, has as its point of departure the basic indicators of creativity collected in the bibliographical index of the most representative authors. It has as its objective the

measurement of traits of the creative person through the perceptions that subjects have of themselves in relation to the indicators of creativity. The TSPC works within a structure of classical theory on the manufacturing of norm-referenced tests. From the start, the indicators are categorised around the subject, process and context. From a perspective of methodological complementarity (quantitative and qualitative), we will complete the definitive design of the questionnaire and its validation; with the aim of being able to define the characteristics of the creative person in relation to his creative products, as it is the creative person who carries out creative production. For this reason, the biographical study of the creative projects of individuals is fundamental to the measurement of creativity.

Finally, it is on this basis that educational models for creative development are elaborated (applicable to various sectors) as well as experiments in educational contexts, which will permit us to know the potential of the models.

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