

Creativity in Business – A design-based research project

Measures and Practices of Educational Technologies for Creativity Training and
Creativity Development

<https://creativityhublab.netlify.app/training.html>

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Abstract

Edith Widder described how “exploration is the engine that drives innovation” (McKenney and Reeves, 2018, p. 90), and I couldn’t agree more, as I naturally found myself navigating between two roles: a role of the Detective – a curious investigator of facts, data, theories, and business viability; and a role of a modest, early-stage Inventor, designing and inventing Creativity Training model for *Telenor* employees to develop skills and knowledge in order to efficiently design and create quality, knowledge-based forthcoming products.

According to McKenney and Reeves, it is crucial to frame research question as initial orientation (2018, p. 124). I therefore decided to clearly formulate it – *How to improve Telenor mobile subscription sales by fostering creativity development of Telenor employees?*

To further develop and set clear fundamentals of the project structure, the paper opens and presents the methods and strategies of Educational Design Research (McKenney and Reeves, 2018). Afterwards, I will in Chapter 2 present the *Creativity Hub* – a digital Creativity Training platform influenced by Dewey’s philosophy “leaning by doing”, and grounded on Cattell-Horn-Carroll, Sawyer, Guilford and Peppler theories of psychology and creativity. Finally, Chapter 3 is all about testing and measuring validity of the Product Creativity. Based on these chronological steps – this project seems to be designed on deductive methodology (Bryman 2021). However, none of the ideas were ever created in a linear form, and this is what describes iterative reasoning. By designing and tailoring Creativity Training digital games, I was simultaneously “going back and forth” adapting research methods and redesigning the theoretical fundamentals to match and fit my vision of Creativity Training model.

Finally, in the recent article by *Dagens Næringsliv*, it is mentioned that *Telenor* created “Norway’s First AI-Factory” (DN Media Group, n.d.). My ambition is to use the best out of this opportunity and design a Creativity Training platform which would be based on, elaborated and trained explicitly on the *Telenor* business data. Moreover, my goal is to make employees gain required knowledge and understandings about tech creative thinking and creative expression in business organization by designing both individual and collaborative learning in the *Mixed-Reality* (UNESCO MGIEP, n.d.).

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Fundamentals

Educational Design Research

In Educational Design Research, there are two fundamental research phases: analysis and exploration phases which both include several activities that are separately prepared and complementarily influenced. The purpose of these phases is to critically and systematically set guidelines upon which the design research project will be built on and further conduct.

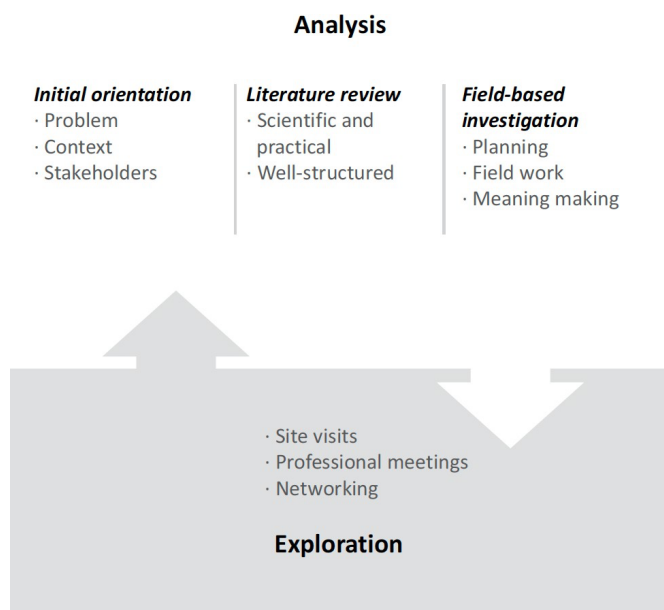


Figure 1: Processes during Analysis and Exploration Phase (McKenney and Reeves, 2018, p. 91)

According to McKenney and Reeves, in the analysis phase of design research, it is crucial to adapt a “holistic understanding of the problem” (2018, p. 96). Therefore, it can be useful to distinguish certain aspects: the existing situation, the desired situation, the context, and the stakeholders (2018, p. 97). Also, by analysing these aspects, several activities will frequently develop in interaction with one another – in parallel, often even way (2018, p. 99).

During the first phase of analyses, the Detective will have to investigate three main activities: initial orientation, literature review and field-based investigation (McKenney and Reeves, 2018, p. 98). There are three useful guiding questions that can help us during this phase: “What do we want to know about the problem? What do we want to know about the context? What

do we want to know about stakeholder needs and wishes (McKenney and Reeves, 2018, p. 99)”??

Next phase regards questioning material context. The material context is crucial in both the analyses and exploration phases. Fundamental activities to material context are:

- Assessing available resources: identifying existing facilities, infrastructure, software, and resources
- Identifying limitations: budget, infrastructure, resources
- Searching for opportunities: additional fundings, forming new collaborations, redesigning and upgrading existing factors
- Viability: searching for strengths, weaknesses, opportunities, and threats (SWOT) that would enable or hinder changes in the setting (McKenney and Reeves, 2018, p. 100).

Furthermore, the Detective’s role will also require engaging in professional meetings, networking, and on-site visits, to examine how and why certain problems were addressed, with what results (McKenney and Reeves, 2018, p. 101). Additionally, the Detective aims to investigate how participants have experienced new changes and challenges, and to elaborate the ideas and decisions upon them.

Three-Stage Training System

As previously I have described how Educational Research Design system is built on, I will now present the Three-Stage Training system through individualistic and sociocultural approaches and understandings of creativity which is incorporated in the Creativity Training model I created.

First Stage regards individualistic assessment of each participant – in this stage members are discovering their cognitive profile by taking Intelligence Test. This stage is called *Game 0*: <https://creativityhublab.netlify.app/chc-assessment>. After taking Intelligence Test, all members will go through 30 days of Intelligence Training.

Second Stage gives the members opportunity to train cognitive skills (divergent and convergent training) independently or in collaboration with other group members: <https://creativityhublab.netlify.app/decision-tree-game>.

Lastly, Third Stage gives the members opportunity to master creative processes and learn by creating new product pitches and ideas: <https://creativityhublab.netlify.app/innovation-sprint>.

Although the Creativity Training System is divided into three stages, approaches to these stages aren't similar. I decided to simulate individualist approach and sociocultural collaborative approach that emphasize group creativity which is known as *distributed cognition*.

Next, I will describe how Three-Stage Training System is implemented into digital games, and then in the Chapter 2, I'll describe in detail each theory on which Creativity Training digital games were designed.

In the *Game 0*, before participants start training creative traits and creative processes, each member will go through Intelligence Assessment and 30-day Intelligence Training: <https://creativityhublab.netlify.app/chc-assessment>. The idea is primarily to collect the data of all trainers, then train the game according to the analysed data. The goal isn't necessarily members to achieve the highest score, but rather, me as the Investigator to collect weak and strength points of each member before they get grouped and continue to collaborate. I found that Ten-Factor CHC Intelligence test is the most relevant because the test provides cognitive facts, and because CHC training system is easy to implement in tech Creativity Training.

In 2013, creativity researchers Lin, Yeh, Hung and Chang created an experimental study and found that participants who have been trained on a hybrid decision-tree game had 90% chance to achieve above-average creativity score (Peppler, 2017, s. 391). This research inspired me to apply "Decision-tree game" of *Game 1*, which include simple decision-tree game, and hybrid decision-tree game: <https://creativityhublab.netlify.app/decision-tree-game>.

Last phase is about "Innovation Sprint", *Game 2*, trainers will practice pitches and ideas on *Telenor* context through eight Sawyer's stages: <https://creativityhublab.netlify.app/innovation-sprint>.

Project Timeline

Project timeline during 6-month journey is envisioned to be:

- Month 1 – *Game 0* Individualist approach: Intelligence Assessment and 30 days Intelligence Training
- Month 2, 3, 4, 5 – *Game 1 & 2* as group training

- Month 6 is the month for Product Creativity testing.

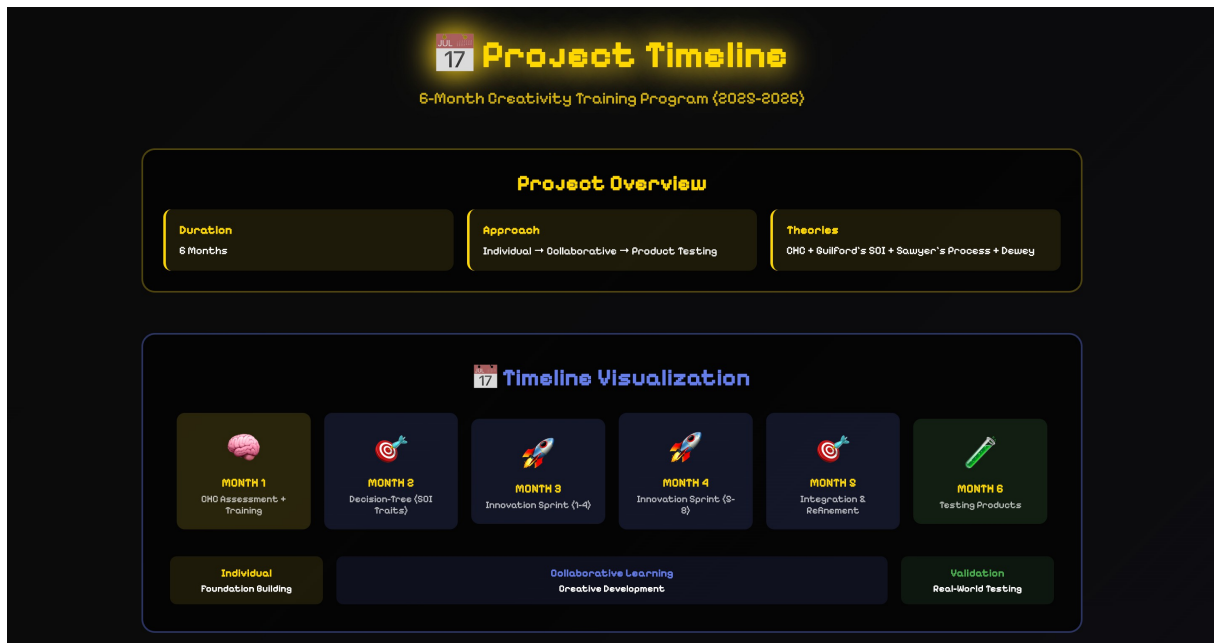


Figure 2: Creativity Training Project Timeline (Source: <https://creativityhublab.netlify.app/project-timeline>)

Creativity Hub

The concept of *Creativity Hub* was previously mentioned in my design research project *The Futuristic Learning Laboratory*. *Creativity Hub* represents the digital sphere, or a digital hub, in which learning and flourishing is centralized in the *Mixed-Reality* (UNESCO MGIEP, n.d.). The concept of *Creativity Hub* is a realistic, yet still futuristic vision worth implementing and standardize.

To bring closer the idea to the readers, I coded and designed my very first *Creativity Hub* platform (<https://creativityhublab.netlify.app/hub>) in which trainers will with technology and though individual and collaborative learning develop multiple skills. Furthermore, *Creativity Hub* isn't just a Creativity Training centre, it is a hub where *everyone* without exception is welcome to test their creativity skills, to train intelligence, and to learn about the theories of creativity and psychology on witch the digital games were constructed on.

In the next section I will elaborate certain creativity and psychology theories which served me to design and code the whole concept.

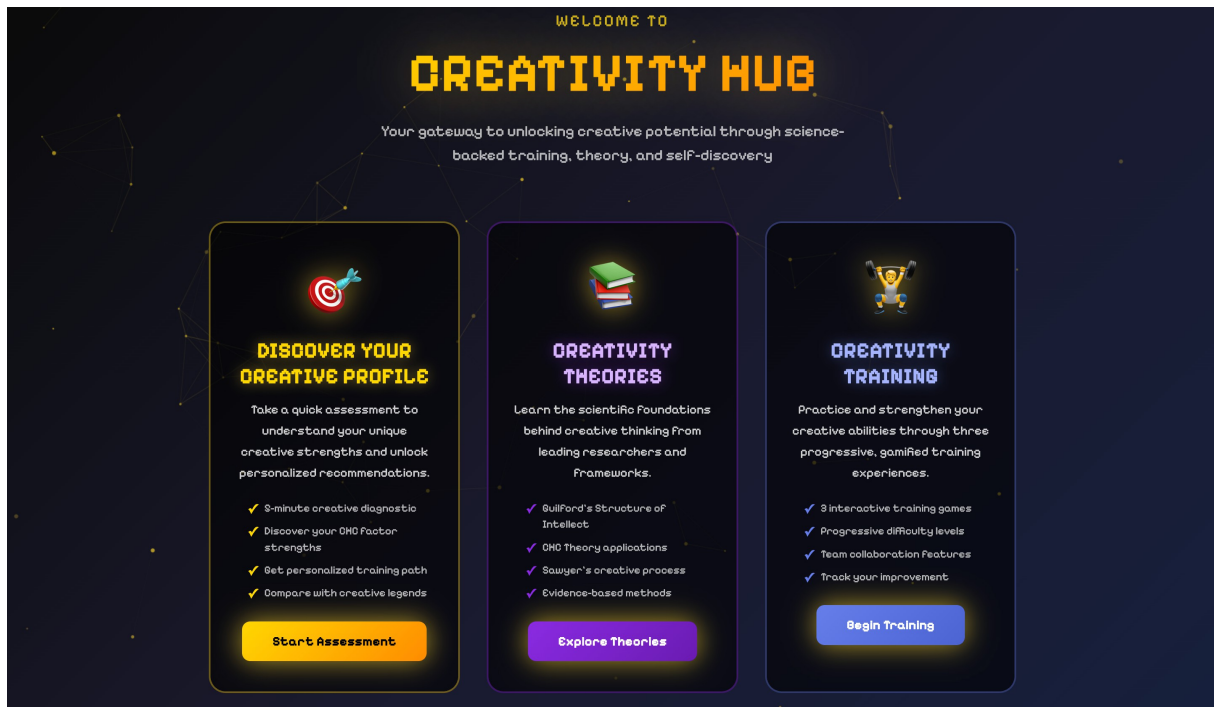


Figure 3: *Creativity Hub* (Source: <https://creativityhublab.netlify.app/>)

Game 0: Cattell-Horn-Carroll

According to Sawyer, “creativity tests shouldn’t be used alone, they should be used in combination with traditional intelligence tests” (2012, p. 57). Therefore, Creativity Training starts with Intelligence Assessment. Afterwards, users will be going through 30 days Intelligence Training. Both Intelligence Assessment and Intelligence Training concept are based on ten-factor Theory of Intelligence by Cattell-Horn-Carroll (CHC). CHC theory combines Cattell-Horn theory of fluid and crystallized intelligence, and Carroll’s Three-Stratum Theory (Sawyer, 2012, p. 54):

1. *Gf* – *general fluid* – abstract reasoning and problem-solving
2. *Gq* – *general quantitative knowledge* – mathematical reasoning and numerical facility
3. *Gc* – *general crystalized intelligence* – accumulated knowledge and the ability to use that knowledge, vocabulary
4. *Grw* – *general reading writing* – literacy skills, language comprehension

5. *Gsm* – general short-term memory – working memory, attention span
6. *Gv* – general visual processing – spatial reasoning, visual patterns
7. *Ga* – general auditory processing
8. *Glr* – general long-term storage and retrieval – memory storage, retrieval – this aspect is connected to Guilford’s *fluency*
9. *Gs* – general processing speed
10. *Gt* – general decision speed/reaction time – mental quickness, reaction time

Game 0 is built on eight out of ten stages. *Ga* and *Gt* factors aren’t included in Intelligence Assessment nor Intelligence Training due to technology-based reasons regarding digital testing.

“Arriving at one goal is the starting point to another.” - John Dewey, Reconstruction in Philosophy (1920)

Game 1: Paul Guilford

Game 1, a decision-tree game, is Creativity Training game designed on theoretical approaches of divergent and convergent cognitive systems (Peppler 2017). The Game 1 is simulating real problem-solving in which trainer is selecting the best solution through critical thinking and logical reasoning by evaluating the business principles and making a strategic decision.

Creativity Training *Game 1* is constructed on Paul Guilford’s six operations – *Structure of the Intellect* (SOI):

1. Cognition – ability to discover, recognize, comprehend, and understand the information
2. Memory recording – process for storing and encoding information for later use
3. Memory retention – ability to store the information over time, and later retrieve it
4. Divergent production – generation of multiple varied solutions, ideas or responses, including four key dimensions: fluency, flexibility, originality and elaboration
5. Convergent production – generation of single best, most logical and conventional answer

6. Evaluation – making judgment about correctness, suitability, adequacy or quality of the information, answers and decisions

Paul Guilford, the father of the Psychology of Creativity, was first to introduce the concept of Divergent Thinking, and he linked four dimensions to the theory of DT:

1. Fluency – the most data score of the total number of the *answers*
2. Flexibility – the most data score of the total number of *responses*
3. Originality – the most data score of statistically *rare, unusual, and original* responses
4. Elaboration – data score of the most *detailed* response (Sawyer, 2021, p. 47)

Game 2: R. Keith Sawyer

As the main goal of this research is *How to improve Telenor mobile subscription sales by fostering creativity development of Telenor employees?* – this *Game 2*, Innovation Sprint game, is especially emphasizing divergent training. *Game 2* is constructed on Sawyer's eight stages of creative processes. First six Sawyer's stages implemented in the *Game 2* are especially fostering divergent training:

1. problem finding and formulating
2. information gathering
3. generation of ideas, and
4. combination of multiple ideas

Last four Sawyer's stages of the *Game 2* involve convergent thinking through conscious attention:

5. generating idea (conscious attention to the problem – generating multiple results)
6. combining ideas to unexpected way
7. applying critical thinking and selecting the best idea
8. externalizing the idea using materials and representations (Sawyer, 2021, p. 90)

These last two stages, evaluation and externalizing the idea, require analytical, critical, and strategic approaches which processes are connected to convergent thinking.

Data Collection

According to McKenney and Reeves, during both the analysis and exploration phases, there are seven methods that are most often used to collect the data: interviews, focus groups, observations, questionnaires, tests, logs/journals, and document analysis (2018, p. 106). However, triangulation of these methods is essential for “enhancing the reliability and validity of the findings” (2018, p. 106).

In my research, I decided for continuing data collection during all training stages. First month, the data will be specifically linked to each trainer; afterwards the participants will be working in the groups, and the data results will be linked to each group. In other words, both the individual data and group data will be collected, observed, and analysed along the way. I decided for this approach because in order to create a valid and sufficient game, the games should always and simultaneously be adapted with new data input based on the new analytical findings. By analysing and observing trainer’s data input and by redesigning and adapting changes and new challenges to the trainers with new data output, new learning possibilities will arise. Additionally, it’s the way how to make the game valid and appropriate.

Furthermore, I haven’t designed the games with specific goal or score to achieve. I envisioned Creativity Training as a never-ending game. This way, all games will challenge the participants to train, master and develop their creativity, cognitive and intelligence skills; also, they would maintain the focus on learning and developing, and be motivated to expand and elevate, instead of to keep the focus and motivation on achieving the grade or score and be done with training. Additionally, they will be able to learn from and about each other and develop knowledge and skills through group creativity known as *distributed cognition*.

In the reference to McKenney and Reeves about *viability*, here I must say that the possible threats and challenges would be the financial costs regarding data collection and constant modification and adaptation of the game. If the *Creativity Hub* would be an open Creativity Learning Hub incorporated in a digital world, the business would have to hire several people who’s the job would be literally to: conduct the employees, train (code) the game, analyse the results, find new solutions – then again, search for the right material that is relevant to the previous data output, and again, to train (code) the game on the new findings. Contrarily, if the Creativity Training would be limited to only six months, the financial costs would still be high due to active research observations, analysis, and conduct of both the trainers and the games;

yet it would be drastically less financially challenging than if the *Creativity Hub* would be a living organ in a digital sphere.

I must emphasize the fact that *Telenor* did invest enormously in AI-Factory (DN Media Group, n.d.), and this fact could support the concept of an open, everlasting *Creativity Hub*. However, I didn't have the opportunity to research and find out the total budget of the *Telenor*'s AI-Factory and how much *Telenor* would be willing to invest in Creativity Training project. Thus, this design research project is mostly based on imagination, yet still designed on evidence-based research.

Product Creativity

In this chapter, I want to emphasize the importance of testing the Product Creativity. According to sociocultural definition of creativity, "creativity is the generation of a product that is judged to be novel and also to be appropriate, useful, or valuable by a suitably knowledgeable social group" (Sawyer, 2021, p. 8). Moreover, Sawyer specifically emphasize *appropriateness* in which creation must be "socially valuable in some way to some community" (2012, p. 9). As a design and creativity researcher, my responsibility is to evaluate the validity, appropriateness and effectiveness of my Creativity Training model.

Since the goal of Creativity Training is to foster *Telenor* mobile subscription sales, participants will be after five-month Creativity Training program tested by creating new products. By evaluating their new products, I will be in the same time able to test the effectiveness of the Creativity Training model.

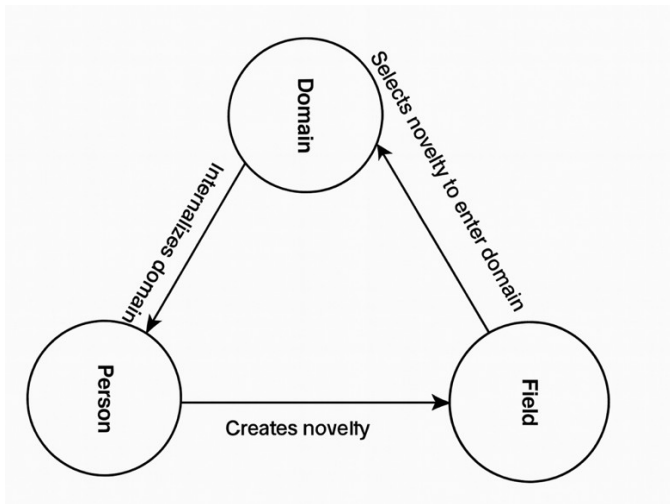


Figure 4: The sociocultural model of Creativity. Image generated by ChatGPT based on Sawyer’s Figure 11.2 (2012, p. 215)

The sociocultural model of creativity (Figure 4) based on Amabile’s and Csikszentmihalyi’s *Systems model* of creativity depicts three components: the person, the field, and the domain. According to Sawyer, the person is the source of innovation which creates a product. Product’s novelty and appropriateness is judged by the experts in the specific field; and, if the product validity is approved, it enters the domain (Sawyer, 2012, p. 214).

In the context of this design research project, it means that the products that will be made by the group members, during the process of evaluation those products will be rated by the experts in the marketing, sales, and technology field; and their judgment will decide if those products are novel and appropriate. However, as Beghetto and Kaufman states, “novelty isn’t enough”. Moreover, the writers refer to Simonton definition of creativity: *Creativity = Originality x Appropriateness* (2014, p. 54). In regard to my research question, I find Simonton’s definition of creativity accurate and suitable in this context.

Although there are many researchers defining the levels of creativity in a different way, usually as a “little-c”, “Big-C”, and variations of those two, I must say that at the moment it would be hard to decide which creativity level would refer the final products of *Telenor* group participants: Would it be a “little-c” which is defined as everyday creativity that contribute level of originality and appropriateness, or would it be a “Big-C” which is more professional and genius level creativity (Beghetto and Kaufman, 2014, p. 54)? It is challenging to define it

since the goal of Creativity Training program *is* to train employees create high-quality products which will foster sales; so, at the end, all trainers *should know how to* and *be able to* create novel, original, appropriate, and high-level professional products and present those products as a group.

Moreover, the “little-c” and “Big-C” isn’t all about creativity traits. The level of creativity is also influenced by domain-general and domain-specific creativity. Hence, it is important to note that I haven’t elaborated those aspects before. Creativity Training games are training *domain-general* cognitive processes using *Telenor* business scenarios as context. I designed this research project assuming that the employees already have *domain-specific* knowledge in network technologies; services and operations; and market and business competence. This means that the games are training members *how* to think creatively, but not *what* to think creatively about. This factor also makes it hard to decide if final products should be seen as the “little-c” or the “Big-C”.

Regarding Product Creativity testing, I would like to mention how Csikszentmihalyi enlisted a team of five professors to help him determine which artworks were more creative by using sociocultural assessment *Consensual Assessment Technique* (CAT) (Sawyer, 2012, p. 91). According to Sawyer, CAT depends on the sociocultural criterion of *appropriateness as evaluated by the community* (2012, p. 42). Participants are asked to create a product and then the Product Creativity is rated by two or more experts from the field; then the average rating is used as a measure of the creativity of each product (Sawyer, 2012, p. 41). This lead as back to the *Systems model* of creativity, in which the field is responsible for evaluating the products through different assessments.

But, according to Sawyer, creativity researchers often use CAT to measure creativity of the product that refers to the “little-c” individual creativity rather than the “Big-C” sociocultural creativity (2012, p. 42). I would therefore, if possible, create a hybrid version of “little-c” and “Big-C”, and adapt it as a hybrid measurement of the Product Creativity level, being tested through the CAT system. In my opinion, the creativity level of the final products could be seen as the hybrid “little and Big-C” creativity level, because those products should be novel, appropriate, and original, *and* created by the team members in which “each member of the team contributes an essential piece of the solution, and these individual components are all integrated to form the collective product” (Sawyer, 2012, p. 224).

Conclusion

I would like to add reviews regarding the processes of creating and designing my research project, and generally about validity and appropriateness of the Creativity Training program.

Firstly, I had period of only two weeks to develop entire concept, and I was bounded on maximum number of pages which I could use to describe and elaborate my visions. I was tightly holding the structure of the design and theoretical fundamentals I set in the beginning, but as the concept was expanding I had no other option than to evaluate the decisions I made and reinvent the old ideas to match the new concept and form.

Thereby, this design research project is far more complex than I could ever image in the beginning. Indeed, my design research project is supported by various theories about creativity and psychology; and all mentioned theories in essence are supporting the concept of the Creativity Training and the game activities. But, the crucial part I lacked is the ability to test the ideas, which during my research I couldn't do.

Also, from the perspective of someone who coded the platform and the games, another important testing should be around technology effectiveness regarding data collection. These are the reasons why in the early stages I stayed focused on domain-general training activities, and why I couldn't dive deeper in the certain areas since I lacked the feedback on validity and reliability.

Lastly, the Creativity Training platform is a universal training model that could be applied across multiple domains and in different settings. But as deeper I dive in the project visions, as more challenging it becomes – the concept is branching out, and it is shouting for support from different field-experts.

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