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Fostering Metacognition in CPS Training – Tools and Techniques

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Fostering Metacognition in Creative Problem Solving Training – Tools and Techniques
by

Anna Packham

An Abstract of a Project
in
Creative Studies

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Science

September 2017

Buffalo State
State University of New York
Department of Creative Studies

ABSTRACT OF PROJECT

Fostering Metacognition in CPS Training – Tools and Techniques

Metacognition is described as the awareness of one's own cognitive processes, as well as the ability to regulate them. This Master's project provides an insight into how metacognition can be integrated into a Creative Problem Solving training with the aim of enhancing the participants' understanding of relevant strategies employed in the context of creative thinking, enabling them to accelerate the application of their learning outside the training environment. A toolkit for metacognitive instruction within a CPS training is provided, consisting of specific tools as well as guidelines and suggestions for the trainer.

Key words: Creative Problem Solving, creativity, metacognition, training, toolkit

A. Packham

Your Signature

6.12.2017

Date

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A Project in
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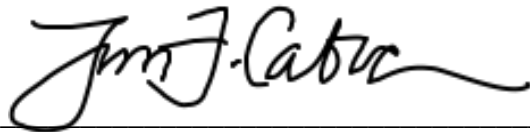
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Name of Project Adviser
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6.12.2017



Name of Student

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SECTION ONE: PROJECT BACKGROUND

Purpose and Description of Project

Since I have embarked on this Master Degree, I have been fortunate to transfer learning into my work environment - either by extending the scope of current activities (i.e., the way in which I plan and facilitate workshops) or by flexing my role into completely new areas.

As an example for the latter, I designed a training course to enhance creativity skills within the organization. As a result of our current organizational climate, which strongly focuses on efficiency and savings, the number of training courses were either reduced or cancelled. Not surprisingly, this made its environment a challenge for me to offer new training courses. However, there are colleagues within the organization who have expressed interest in learning more about creativity and who were enthusiastic about the opportunity to expand their skills. This led me to think about a different, more flexible type of training: an intense, short-term, interaction delivered face-to-face or through a platform for online collaboration.

The purpose of this training is to provide participants with the foundations of Creative Problem Solving (CPS) (including an overview of the CPS framework, process steps, and some selected tools alongside key behaviors and attitudes) through the use of metacognition, within their own work context. The learning will take place at a practical level whereby CPS tools are used to structure their thinking while they work towards addressing a challenge creatively, and at a metacognitive level, as they think about their own thinking in relation to how they applied CPS tools and strategies. After the training period, trainees will be in a position to expand the application of CPS tools more reflectively to new challenges in their personal and professional environments; they will also be encouraged to apply their skills to facilitate team discussions, lead groups, provide customer service, to name a few. While this

extension is not part of the master's project, I am motivated to help trainees internalize their learning in many other areas.

In terms of personal creativity and leadership goals, I see this project as an opportunity to further apply some of the guiding principles I have established for myself during a previous course (CRS 635) and which stem from my vision for myself as a creative leader.

Here are three goals I see most closely connected with this project.

Unlock a creative skillset

I want to unlock the creative skillset for myself and for others. In the context of this project, this would mean to establish awareness within the participants for creativity as a structured approach. In particular, I see a great benefit in exposing participants (or co-workers) to the flow and compelling logic of a creative process that is supported by divergent and convergent thinking guidelines as a means to augment their current approaches to collaboration.

For myself, I expect some great insights and learning from the conscious application of strategies to foster metacognition. I might benefit from this in the form of more fluency in the choice of tools I employ in a collaborative setting and enhance my skills as a facilitator and trainer.

Make creativity contagious

In my company, creativity is not established as a 21st century skillset; rather, a small number of tools is seen and used in isolation and without much appreciation for the overall mindset behind it. Within this project, I would like to establish the basics of Creative Problem Solving as an underlying logic to structure one's thinking. I hope that participants find access to the cognitive, rationale and semantic structure that CPS provides and that this can become a joint language which might eventually spread and become more established across parts of the company – also in terms of affective qualities, influencing behaviours and attitudes employed in business communication and team work.

Experiment and improve

One goal of this project is to come up with a flexible training structure. This means that while a certain underlying structure and logic should exist, I want to give myself the freedom to respond to the requirements of the group or individuals and make changes on the fly. I want to challenge myself to continuously improve my training approach and to include insights from previous trainings into the next one. Reflection should therefore be an integral part of delivering this training.

Rationale for Selection

Agility, transformation, and digitalization are currently some of the most frequently used buzzwords in my company. Innovation approaches and tools like Design Thinking, Business Model Canvases and Value Proposition Frameworks are talked about, with often only a superficial understanding. Little attention is paid to the cultural change required to support these approaches, and the overall understanding of creativity as a structured approach to facilitate the different phases, tools, and the corresponding mindset of a creative process.

I feel that I have built a very rich base of knowledge in this field, also beyond the direct context of the Master Degree, and have sought to participate in this movement towards more innovation (and possibly creativity) that is currently going on in the company. I want to use my knowledge to create an overall awareness and “fluency” regarding creative thinking and the relevant tools. I would like this project to contribute to this goal by making creativity a skill and toolset that more people have access to.

From a personal perspective, there are two skills I would expect to enhance. First, I would like to gain more experience particularly when facilitating small groups or engaging in one-on-one discussions. I enjoy helping others to learn, grow and realize their potential. In some ways, this flexible, small-scale training setup might allow me to experience a situation where I would almost act like a coach for the participants, helping them to work through their

creative challenges. I expect this to be an insightful experience for myself, to which I might consider coaching as a potential future career path.

Secondly, I would like to understand how I might be able to foster metacognition as a skill for participants to leverage, which would allow them to reflect about themselves and continue their personal and professional growth long after our direct interactions have finished. This resonates with my favorite creativity definition that creativity means being able to modify self-imposed constraints (Ackoff & Vergara, 1988). With a focus on metacognition, I should be able to increase my own knowledge of this field and add to my awareness and skills as a trainer and practitioner of CPS.

SECTION TWO: PERTINENT LITERATURE

I see this project mostly as a practical, hands-on experience. The literature review is therefore focused on gaining insights and building relevant knowledge, techniques and tools in the area of metacognition. In particular, the literature listed below helps me to:

- understand the concept of metacognition and its elements and possible links to creativity
- understand existing strategies and tools that have been researched or implemented in order to enhance metacognition

Metacognition: Concept and elements

Flavell first introduced the term metacognition, which he described as “one’s knowledge concerning one’s own cognitive processes or anything related to them” (Flavell, 1967, p. 232). The border between what is metacognitive and what is cognitive can sometimes be difficult to draw, and it has been stated that the two may be mutually dependent on each other and thus cannot be entirely separated (Flavell, 1979). Garner (1987) stated that cognition and metacognition differ in that cognitive skills are necessary to perform a task, while metacognition is necessary to understand how the task was performed. More specifically, the difference lies in the goal of the activity: Cognitive activities help to acquire, retain and transfer knowledge for task execution, whereas metacognitive activities allow one to regulate and govern task execution (Ku & Ho, 2010).

Metacognition includes both the knowledge and the regulation of an individual’s cognitive processes (Brown, 1987; Flavell, 1979; Schraw & Moshman, 1995). Metacognitive knowledge encompasses acquired knowledge about cognitive processes, which can be used to control them. Flavell (1979) distinguishes three categories: knowledge of person, task and strategy variables. In brief, person variables refer to one’s awareness of one’s own learning processes, for example under which conditions focused learning can take place; task variables

describe the knowledge of the task and respective processing demands; and finally strategy variables include the knowledge of cognitive and metacognitive strategies, as well as knowing when and where it would be appropriate to use them. Again, it may be challenging to define the difference between cognitive and metacognitive strategies. When considering that metacognition is often defined as “thinking about one’s thinking”, the difference becomes however clear: Cognitive strategies are used by an individual to help achieve a particular goal (e.g., reading a text), metacognitive strategies are used to support the process of reaching the goal (e.g., quizzing oneself to evaluate satisfactory understanding of the text) (Livingston, 1997). As such, metacognitive strategies often come into play when cognition fails, preceding or following a cognitive activity (Livingston, 1997).

To be sure, metacognitive regulation consists of three elements: planning, monitoring and evaluation. Planning includes the selection of appropriate strategies; monitoring requires sense-checking of task information and identifying ambiguities in information; and, evaluation involves the examination and correction of cognitive processes, including revising conclusions (Schraw, 1998). In short, regulation allows an individual to react and make adjustments to their use of strategies.

Metacognition in creativity

Armbruster (1989) confirms that metacognition does play a role for most of the creative process, helping individuals assess their level of knowledge, evaluate the potential of their ideas, and verify that the product created measures up to internal and external standards. Only the stage of illumination, being highly unconscious, eludes itself from the application of metacognition (Armbruster, 1989). Puccio, looking specifically at Creative Problem Solving as a creative process, finds that metacognition allows the individual to stand above the entire process and serves to manage his or her progress throughout all stages (Puccio, Murdock & Mance, 2010, p. 74).

Fostering metacognition

Metacognition has been found to be domain-general and, maybe more importantly, teachable (Schraw, 1998). This means that training interventions can be designed in order to enhance different components of metacognition. According to research, these components of metacognitive training include three areas: (1) metacognitive knowledge and skills – the practice of (task-specific) strategies; (2) metacognitive (self-) regulation – the practice of planning, monitoring, orchestrating and evaluating skills and strategies; and, (3) awareness – gaining information about a skill’s rationale and usefulness and creating an environment that supports metacognition (Anderson, 2002; Brown & Baker, 1984; Hartman & Sternberg, 1993; Schraw, 1998).

Metacognitive knowledge

Interestingly, a broad consensus seems to suggest the need to explicitly introduce participants to the concept of metacognition (Baker & Brown, 1984; Schraw, 1998) - allowing participants to become aware of different stages of a learning process and increasing their motivation to reach the top of Maslow’s hierarchy, self-actualization (Apaydin & Hossary, 2017). Self-actualization (Goldstein, 1940; Maslow, Frager & Fadiman, 1970) describes the final stage in Maslow’s hierarchy of human needs where an individual is able to reach its full potential, including creative growth (Maslow, 1968).

Paris and Winograd (1990) describe four approaches to instruct metacognitive knowledge: metacognitive explanation and modeling, scaffolded instruction, cognitive coaching and cooperative learning – which mostly differ in regards to the instructors’ involvement in the teaching.

Metacognitive explanation and modeling can be best described as explicit teaching of strategies, where the teacher explains and teaches selected strategies and models them for the student, for example by thinking out loud and verbalizing thought processes (Randall, Fairbanks & Kennedy, 1986).

Scaffolded instruction extends the approach of metacognitive modeling by establishing a dialogue between student and instructor, ensuring a mutual flow of information. In this setup, instructors may ask questions or encourage discussion as well as elaborate on student's use of strategies, assist in their use, and give feedback (Rickey & Stacy 2000). This approach has been found to lead to significant improvements compared with direct instruction, as students seem to internalize information faster, and are able to transfer strategies to other fields and contexts (Paris & Winograd, 1990).

Cognitive coaching again expands the scope and includes dialogues, explanations, modeling and encouragement. The focus lies on the use of metaphors, analogies, visuals, posters or worksheets, which are used in connection with discussions in order to make abstract learning tangible; the shared goal and mutual understanding of student and instructor take a central role (Paris & Winograd, 1990).

Cooperative learning concentrates on the interaction between learners. It often includes a mixture of instructional practices, which encourage students to reflect, discuss, exchange and help each other. This can be done in groups of varying size or in pairs.

Instructional programs designed to increase metacognitive knowledge commonly focus on four different elements – the explicit teaching of a strategy, alongside with explanations about how to use it, when to use it and why to use it (Winograd & Hare 1988). Independent of the approach chosen, and in order to keep track of the strategies that have been identified, Schraw (1998) describes the use of a tool called “strategy evaluation matrix” (p. 120). This matrix can be used to list strategies that are taught, or to prompt learners to identify strategies themselves.

Metacognitive regulation

Once a learner has become aware of the existence of different metacognitive strategies, the focus is on the efficient application of these strategies. Rather than using elaborate tools, different studies have found that simply asking questions helps to foster

metacognition in these regulatory phases of planning, monitoring and evaluating strategy. Schoenfeld (1985) used metacognitive questioning to help students monitor their (mathematical) problem-solving performance, and found that performance could be improved if students were required to stop periodically and ask themselves reflective questions such as “What am I doing right now?”.

Further research suggests that the explicit teaching of monitoring strategies, for example in the form of a checklist, can significantly enhance an individual’s performance and efficiency (Delclos & Harrington, 1991). King (1991) specifically focused on enhancing problem-solving strategies amongst students and suggested that such a checklist should use generic, content-free question stems that invite students to reflect upon their thought processes. A checklist or prompt card covering all areas of metacognitive regulation may contain as much as 15 items, including questions such as “What are we trying to do here?”, “Can we use a strategy?”, “Are we on the right track?” and “What would we do differently next time?” (King, 1991).

Alternatively, students could generate their own questions, which are then used for peer discussion. This guided peer-questioning and responding was found to be more effective than an unguided discussion, independent review or questioning and responding without guidance (King, 1991). Similarly, Schraw suggests the use of a “regulatory checklist” (see Figure 1), designed to enable learners to implement a systematic regulatory sequence for planning, monitoring and evaluating strategies (Schraw, 1998). Importantly, King finds in her study that students that used the guided questioning approach seem to internalize this strategy since they perform better even in novel problems from the same context for which strategies had been developed (King, 1991).

Planning

1. What is the nature of the task?
2. What is my goal?
3. What kind of information and strategies do I need?
4. How much time and resources do I need?

Monitoring

1. Do I have a clear understanding of what I am doing?
2. Does the task make sense?
3. Am I reaching my goals?
4. Do I need to make changes?

Evaluating

1. Have I reached my goal?
2. What worked?
3. What didn't work?
4. Would I do things differently next time?

Figure 1. Example for a Regulatory Checklist. Reprinted from “Promoting general metacognitive awareness” by G. Schraw, 1998, *Instructional Science*, 26, p. 121. Copyright [1998] by Kluwer Academic Publishers.

Within the field of creativity, Puccio, Murdock and Mance suggest a similar approach to the checklist described above that allows practitioners to determine if Creative Problem Solving should be applied to a situation, and if yes, determines an entry point in the CPS process. These tools are called the “4I’s”, “Keyword Search” and “If-Then Process Analysis” (Puccio et. al., 2010, p. 128 – 133).

Metacognitive awareness and environment

While building a strategy repertoire and assessing its effective use are seen as distinct but complimentary areas, research also highlights the need for a conducive learning environment. Schraw (1998), for example, sees an extended regular practice and self-reflection as part of a building general awareness process of metacognition that is situated outside of specific strategies. Self-reflection can be enhanced on an individual level, for example, through a personal reflection journal, or through group discussion (Schraw, 1998). According to Tanner (2012), reflection could be stimulated by a set of given questions (i.e.,

what are the three most important things you learned in the previous class?). Hargrove and Nietfeld (2015) also strongly support the idea to make room for group discussion in order to review the meaning and usefulness of tools that have been applied, but also to help anchor the learning and allow for an opportunity to clarify any misunderstandings.

Overall, it is clear that a body of research exists which my training can draw upon. Different tools and strategies have been outlined which support the acquisition of metacognitive knowledge or foster metacognitive regulation. Amongst those, the Strategy Evaluation Matrix and the Regulatory Checklist may particularly lend themselves to being adopted into a Creative Problem Solving environment. Different teaching approaches, from direct teaching to modeling and guided discussion and reflection, have been identified and can be drawn upon for the CPS training I am planning to introduce.

The next section will outline the suggested training content and goals as well as the overall project timeline and suggestions for the evaluation of the project.

SECTION THREE: PROJECT PLAN

Plan to Achieve Goals and Outcomes

I expect to design two tangible outcomes from this project: a scalable Creative Problem Solving training design (or approach) and a toolkit to foster metacognition, which will be applied in the training I design and may serve as a resource for others who are seeking to introduce metacognitive instruction into their trainings.

The training approach will be designed in a way so that it can be used for different group sizes, with the intention to focus on small groups (up to 5 people) and even in a one-on-one discussion. This training will have some flexibility regarding the delivery mode: While groups are likely to be facilitated face-to-face, individual trainings can also occur in an online platform. Especially in this case, the training will be split into a sequence of shorter sessions, while group training will be delivered as full day training intervention (course or workshop).

The training will cover a selection of CPS tools that are chosen for relevance and applicability in the participant's working context. The training will allow the participants to experience the CPS approach based on their own input; this means their own visions and challenges will serve as a starting point to explore the CPS framework and tools. This training should allow participants to become familiar with a sub-set of CPS tools and in particular to build awareness for the rhythm of divergent and convergent thinking.

In parallel, and building on existing research, I will develop a toolkit that can be used to foster metacognition. This toolkit will build on existing research on metacognitive instruction, particularly in the areas of metacognitive knowledge and regulation, and will entail specific tools like the Strategy Evaluation Matrix or the Regulatory Checklist. These tools may be adapted in order to fit with the suggested CPS instruction, and may be supported with additional material, which will summarize my insights and experiences and may serve as a starting point for other trainers who seek to include metacognitive instruction into their

(existing) CPS trainings. The inclusion of metacognitive tools should help participants to better monitor their own thinking and identify strategies to apply creative thinking more successfully. In addition, the toolkit should provide a starting point for other trainers and facilitators who are interested in including this content into their (existing or new) training, seeking to improve and accelerate their participants' learning.

The next sections serves as a high level outline of the timeline for this project.

Project Timeline

September 4th - September 15th

- Review existing projects
- Work on and submit concept paper draft and revise based on feedback (due: Friday, Sept 15th)
- Exchange with advisor and sounding board partners

September 16th – September 22nd

- Start Project work: design training and start first round of training interventions
- Research the topic of Metacognition and include suitable coaching questions into training
- Review a Published Project and discuss with SBP and instructor

September 23rd – October 20th

- Work on draft for sections 1-3 (due: Friday, October 20th)
- Continue training including metacognition tools
- Make time for reflection on training success and iterate training approach as necessary
- Exchange with SBP as needed

October 20th – Oct 27th

- Continue training, note-taking and evolving the training. Aim to close training towards Oct 27th.
- Collect insights on metacognition tools
- Collect unstructured feedback from participants where possible
- Understand participants need/interest for further activities or possible need for support to enhance their skills beyond the training and support where possible
- Exchange with Sounding Board Partners (SBP) as needed

October 27th - November 17th

- Continue to collect feedback and insights from training
- Provide support for participants to apply learning towards own projects/challenges
- Work on draft for sections 4-6 (due: Friday, November 17th)
- Exchange with SBP as needed

November 18th – December 1st

- Work on final draft sections 1- 6 (due: Friday, December 1st)
- Exchange with SBP as needed

December 1st – December 8th

- Final project including references, appendices, layout (due: Monday, December 8th)

December 9th – December 15th

- Prepare Presentation incl. Digital Commons Upload according to guidelines

Activities and estimated time

Project activities and duration times to complete activities

- design training/coaching draft around CPS stages and decide on core tools: 3 hrs
- research on metacognition and strategies/tools to implement: 10 hrs
- development of draft guiding questions/script to enhance reflection and metacognition: 3 hrs
- run virtual training intervention for selected individuals; stagger start so that learning can be included into improved setup (9 hrs per individual): 45 hrs
- prepare, run and iterate the face-to-face training setup (3 full-day sessions): 35 hrs
- keep notes on individual training progress and plan next steps after each intervention; keep online training workspace updated: 10 hrs
- reflect upon and evolve training setup including metacognition questions: 3 hrs
- Total: 110

Write-up activities and estimated times:

- Exchange with Advisor: 3 hrs
- Sounding Board exchange and calls: 5 hrs
- Finalizing concept paper: 4hrs
- Draft sections 1-3: 5 hrs
- Draft sections 4-6: 12 hrs
- Layout and final revision of report: 10 hrs
- Project presentation: 5 hrs
- Total: 44

Total time estimated: 154 hrs

Evaluation Plan

Looking at the two tangible outcomes this project is designed to deliver, I would describe this project as successful if

- I designed a training framework that is flexible (i.e., in the number or type or sequence of tools that are used; the starting point that is chosen depending on the participant's situation etc.) yet cohesive (gives relevant insight and overview of the Creative Problem Solving process and ensures that the logic and semantics of the approach are shared)
- I have deepened my knowledge about metacognition, inside and outside of the context of creativity
- I have explored (diverged and converged) a number of possible strategies to support or enhance the development of metacognition, tested a number of them and made personal conclusions on the applicability (as far as possible within the timeframe of the project; more testing and learning might be required outside the project framework). I would be happy to stop after trying two or three different tools out of a potentially larger set of tools.
- I receive feedback from participants indicating that they benefitted from our interaction (i.e., through a perceived enhancement of their skillset, increased confidence or other personal development, change of mindset regarding creativity as a skill etc.)
- I can give insight to and a number of examples regarding how this project made me a better creative leader (i.e., how I helped to unlock the creative skillset and made creativity contagious, or how I dared to experiment and unlocked options for my own future development)

I am planning to run a review of my project (using a CPS tool called POINT; covering pluses, opportunities, issues and new thinking to explore the future path) to wrap up and deepen my learning towards the end of the training implementation phase, including personal insights and participant feedback. This will also include a reflection on my personal learning goals in terms of the guiding principles as outlined in section 1.

The next section will detail and explore the key process steps and outcomes that were achieved as part of the implementation of the CPS and metacognition training.

SECTION FOUR: OUTCOMES

The development of the training intervention, including the aspects of metacognition, took place in four stages: developing a flexible training agenda for face-to-face and virtual platform delivery, piloting the training in both settings, including metacognition instruction in both training settings, and rolling out the training.

The reason behind not including metacognition instruction from the start was twofold – firstly, I wanted to start as soon as possible to allow for improvement of the training approach. Secondly, I wanted to give myself the opportunity to contrast the experiences of those who had been exposed to the topic of metacognition at different stages of the training with those who hadn't been.

As a first and fundamental step, the training design had to be outlined taking into account elements such as the training objective, target audience and adaptations required for the virtual training.

Training Design

Objective of the Training

The current organizational reality of my company, as described in the first section, is an important factor when formulating training objectives. First, the training should provide insights into Creative Problem Solving in a way that helps to establish the approach as a relevant addition and skill in the company's "digitalization agenda". Most importantly, CPS should be presented as a holistic framework, while providing a deep-dive into selected tools to counteract the current situation in the organization, where knowledge is fragmented and often only includes a few, selected tools that have their origin in Design Thinking or Project Management. This means that the training had to cover the entire CPS process and (if possible) include takeaways on behavior and attitudes for creative thinking.

Any tools selected for closer discussion and exploration in the training context should be immediately relevant and applicable for the participants, for example, to facilitate personal problem solving as well as team discussions or customer workshops. Participants should experience the creative heartbeat of divergent and convergent thinking, which is present in every stage of the CPS process. Divergent thinking describes the process of generating many options, ideas, solutions, using non-linear and explorative thinking, while convergent thinking helps to narrow down choices and identify those items that should be explored further. Both process steps should be clearly separated one from another in order to enable creative thinking. Prior to the training, optional FourSight assessments were offered to the participants. FourSight Thinking Profiles (Puccio, 2002) are a specific type of assessment, which provide a link between personal thinking preferences and the different stages of a creative thinking process such as CPS. The profile can help individuals to explore and understand which phases of a creative process they feel naturally drawn to, and which ones they might perceive as energy draining. This can be a valuable insight for those who seek to understand the dynamics of the creative process, both when experiencing it as an individual or a team, as the awareness of existing preferences can help to avoid conflicts amongst people with different preferences and thinking profiles.

The goal of both the virtual and face-to-face trainings was to provide enough detail on the overall creative process and tools to enable people to apply CPS thinking and the introduced tools. This will facilitate a tangible experience by allowing participants to work on their own topics and challenges while progressing through the training content.

Target Audience

The target audience for this training, both for the virtual and face-to-face set-ups, included individuals that were known for their personal interest in strategic topics such as innovation, creativity, culture change and future skills and capabilities; they were assembled from different parts of the business, business units, teams or functions. This helped to review

the training approach and obtain well-rounded feedback. In addition, some participants from an operational background were involved to test the applicability of CPS as a model to facilitate very different kinds of problem solving endeavors (strategic and tactical), serving to establish a common language and mindset across the entire business.

While the first trainings were only delivered to people I knew personally or had worked with before, the later trainings included people I didn't know and who were selected because of their high interest and motivation to learn about this topic.

In the future, I will select a broader group of participants; however, I see a clear benefit in aligning the audience's expectations ahead of the training in order to gain maximum impact while retaining a small group size.

Participant feedback has confirmed that if the training were to be delivered to employees with more operational roles (site managers, general managers, supervisors or shop floor workers) the language of the training (as well as parts of its content and delivery) would have to be adjusted to fit their needs and requirements.

Adaptations for the virtual training

While both trainings were built off the very same agenda, some changes were made to allow for a remote setup. The face-to-face training was outlined as a full-day training (8hrs plus breaks) for a small group of people (maximum of 6). The decision to aim for a smaller group size allowed for an intensive learning environment and encouraged questions and discussions.

The main difference between the virtual training and the face-to-face was that the virtual targeted the individual learner, meaning a 1:1 participant-trainer interaction. This made for a more intimate exchange that can be tailored to the participants' requirements, e.g., when considering the depth to which different tools are explored. Depending on the background of the virtual training participants, they were encouraged to choose whether they wanted to explore a given tool in-depth, or (whenever suitable) try out a number of different tools

instead. This freedom to influence the depth versus width of discussion proved to be an excellent option, particularly for those individuals who had a background in training or facilitation themselves and were interested in learning about many different tools.

While the face-to-face training was delivered as a full-day training, the virtual training was chunked into seven sub-sessions, ranging between 45 min and 1.5 hours in length, depending on the content to be covered. In order to provide a cohesive and time-framed learning experience, the aim was to conduct 2 sessions a week. I opted for an overall training duration of approximately 8 hours to allow for a high-level run-through of the entire CPS process including applied practice, discussions and reflection time, while meeting the organization's requirements regarding total training duration (see Appendix A and B for a high-level training agenda for face-to-face and virtual training, respectively).

In between sessions, the virtual training participants were frequently required to complete simple sub-steps themselves, following instructions given by the trainer. Their insights and reflections were debriefed as part of the next virtual session. This was enabled by the use of an online brainstorming platform (www.ideaflip.com), which allows real-time collaboration during sessions and also the capturing of content and progress asynchronously between sessions. Lastly, the virtual training did not include exact and fixed timeslots for metacognition; rather, the trainer reacted to the trainee and their needs in a more fluid way.

The next section is going to give a more detailed insight into the specific training content for both the Creative Problem Solving tools and the metacognitive instruction.

Training Content

In order to maintain a similar training experience for both virtual and face-to-face training participants, both trainings were applied based on the same agenda design. Appendix A shows the full training agenda for the face-to-face training, which covers all phases of the

CPS process with additional timeslots dedicated to the subject of metacognition. Appendix B gives an overview of the virtual training structure.

Creative Problem Solving

The most important goal of this training was to familiarize participants with the structure and logic of the Creative Problem Solving Approach. Before introducing this topic to the participants, some time was dedicated on “setting the scene” in order to provide a rationale to engage the topic of creativity in a business context. This included a definition of creativity as a rational, cognitive, semantic process; the benefits of applying creative thinking in a business environment and first, high-level overview over the four phases of the CPS process: Clarification, Ideation, Development and Implementation. A large flipchart was set up to serve as a main focal point, which I used to draw an overview of the CPS cycle, starting from scratch and adding more and more detail as the training progressed.

Building on the flipchart overview of the four stages, the individual steps within the stages were briefly discussed in more detail. Already at this early stage, participants were introduced to the flow of divergent and convergent thinking that linked the different steps and phases of the process. The practical part then began by exploring the first stage of the CPS process, Clarification.

Both training setups required participants to do some pre-work in order to accelerate the start of the session. Prior to the training, they received instructions via phone and/or email to diverge on vision statements, starting with “It would be great if...” or “I wish...”. I also shared a list of personal examples that included statements such as “I wish I had a dog”; “It would be great if I could have more impact on my career choices”; “It would be great if I could spend more time with family”. The aim was to come up with 20-30 statements. This personal input was then used to experience all the following tools and stages in an applied way, allowing participants to understand and contrast how the different tools might enhance, alter or stretch their thinking.

Relative to the overall training duration, slightly more time was dedicated to the Clarification stage. This is because Clarification is perceived as a skill that is particularly underrepresented in our business and customer interactions. The modeling of strategies and behaviors was also very important right from the beginning of the training and so more time was included for reflection, discussion and warm-ups in the first parts of the training.

The training then advanced through the other CPS phases: Ideation, Development and Implementation. In every phase, the trainer presented selected tools to demonstrate the essential content of each phase – coming up with and verifying ideas; developing ideas into a solution concept and detailing actions to enable the implementation of the solution. These tool demonstrations were alternated with time spent on discussion, reflection and (in face-to-face sessions) time for quiet practice. This required the trainer to change roles among trainer, facilitator and subject matter expert.

Table 1

Overview of CPS tools included in the training including links to video demonstration (where available)

Tool (in order of use)	Reason for inclusion in the training
(Silent) Brainstorming	<p>Brainstorming is a tool that facilitates divergent thinking (i.e. listing many different options, ideas, possible solutions) which can be conducted individually or as a group. As opposed to Brainstorming in a group set-up with post-it's, in this situation participants were asked to complete a brainstorming as an individual, silent exercise ahead of the start of the training.</p> <p>Aim: To come up with a long list of vision statements; participants get the opportunity to discuss and reflect how easy this first divergent step was</p>

for them and what kept them from coming up with more items.

For a video facilitation example, see Osborn (2013g).

3I's

3I is a tool used to verify whether the application of CPS is advisable for a given vision or challenge. There are different versions of this tool, 3I's or 4Is – in our context, participants check their statements for Influence, Immediacy and Imagination to determine if CPS is a strong fit.

Aim: To create awareness that certain problems (particularly algorithmic problems where a single correct answer exists or an existing process can be used to correct the situation; see Puccio et al. 2010, p.35 for more detail) do not require creative thinking to be resolved, while heuristic problems (where there are multiple possible answers, approaches and processes to solve them) benefit from the application of CPS. This knowledge should help participants to identify situations and problems for which CPS will be a suitable approach, and to acknowledge that other, formulaic problems should be tackled with other problem solving approaches.

Purge

Purge is a tool that originally stems from a problem solving technique called Synectics (Gordon, 1961). The purge can be described as the first step in a divergent thinking exercise, capturing the intuitive, initial ideas or apparent solutions in response to a given problem. The output is simply captured in order to provide room for more creative thinking as facilitated with the following tools.

Aim: To highlight the difference between intuitive responses and those facilitated with creative thinking tools in later stages; helps to contrast habitual, obvious responses with the stretch and shift of mind real

brainstorming involves.

Ladder of
Abstraction

The Ladder of Abstraction is a tool that facilitates the divergent thinking step required to transfer a single vision statement into a long list of associated challenge statements. The tool supports this divergence by asking “Why” a vision is important and “What is stopping you” from making progress on the vision. In this training set-up, the Ladder of Abstraction was facilitated as a two-step tool where first statements are gathered, then turned into challenges.

Aim: To diverge on challenge statements by helping to uncover root causes and underlying complexities. It helps to highlight the benefit of applying divergent thinking in the stage of challenge phrasing.

Particularly in a business context, the tool appeals due to its logical structure, while still driving exploration, diversity and new thinking.

For a video facilitation example, see Osborn (2013f).

Boundary
Examination

Boundary Examination is a tool that helps to diverge on challenge statements, taking a given (blunt, unrefined) challenge statement as a starting point. After identifying the key word of the challenge statement, a long list of synonyms and associations is derived. These are then used to rephrase the challenge statement, often in a more playful, explorative, open-minded way.

Aim: To diverge on challenge statements in a more playful way; including this tool into the training provides an opportunity to contrast the more analytical approach of the Ladder of Abstraction with a more playful tool; helping participants to discover and discuss the benefits of each tool and when they might be best used.

Highlighting	<p>Highlighting is a tool used for screening options and making choices (converging) and can be used across all phases. Highlighting contains three sub-steps: Hits, clustering and restating. “Hitting” means to look through all options you have created in the divergent phase and mark (with a check, or colored dot) all of those that seem particularly intriguing, compelling or relevant. Clustering means to create groups based on the items selected in Hits in order to avoid duplication. Restating is the process of synthesizing the different items that form a cluster into one cohesive statement (for example: a cluster of challenge statements will become one, overarching challenge statement; a cluster of ideas will become an elaborated idea).</p> <p>Aim: To converge from a large set of options while reviewing, refining and synthesizing the content.</p> <p>For a video facilitation example, see Osborn (2013b).</p>
Forced Connections	<p>Forced Connections is a tool that facilitates divergent thinking in the Ideate phase, leveraging pictures or objects as an inspiration for idea generation. In this training, this was facilitated in two steps – deriving a list of associations from a picture, and then re-applying these to the topic before eventually asking participants to do come up with new ideas directly after looking at a picture.</p> <p>Aim: To provide insight into tools which help to tease out new thinking while being more “facilitated” than brainstorming, yet easy to adapt to the business environment. Great for practicing strategy use.</p> <p>For a video facilitation example, see Osborn (2013a).</p>
SES Box	<p>The SES Box is a highly structured tool to support the generation of new</p>

ideas.

In a first step, the key word within the challenge statement is identified.

Next, a list of analogies for this keyword is assembled. One of the analogies is selected and characteristics of this analogy are listed in a brainstorming. Finally, the characteristics are used to drive the generation of new ideas for the original challenge.

Aim: To diverge on ideas is a highly structured, guided way that encourages participants to trust the power of the tool even though outcomes only become visible in the very last step.

POINT

POINT is a tool that is firmly linked to the Development stage of the CPS process. POINT is an acronym; it provides a structure that allow to review the strong sides of a solution concept (Pluses), reviews additional aspects of the solution (Opportunities), lists out possible weaknesses of the solution concept (Issues) and supports the further development of the concept (New Thinking).

Aim: To provide a structured tool that is intuitive to follow and can easily transferred to business situations.

For a video facilitation example, see Osborn (2013c; note – this is for the tool “PPCO” which is similar in structure and outcome).

Targeting

Targeting is a tool that can be used to evaluate, discuss and develop the content of a specific stage; within the Development phase, Targeting can be used to review the maturity of an idea and help define future detail or actions. Within the Implementation phase, Targeting can be applied as a way to understand different stakeholder positions in regards to the proposed solution and how they may be influenced to change these

positions.

Aim: To provide a less structured, more intuitive approach than POINT, great for use in business with teams or groups.

For a video facilitation example, see Osborn (2013e).

Assisters &
Resisters

Assisters & Resisters is a tool used to assess the positions of important stakeholders who are involved in the implementation of the solution. For each stakeholder, bespoke actions are derived in order to assure their support for the solution or change.

Aim: To highlight how divergent and convergent thinking can feature in stakeholder management; making the step change between ideas and actions evident.

For a video facilitation example, see Osborn (2013d; note- this is for the tool “Stakeholder Analysis” which is somewhat similar):

<https://www.youtube.com/watch?v=fYatFyQ6XxY>

How-How
Diagram

The How-how diagram is a tool to facilitate divergent thinking when coming up with actions. This tool helps to formulate actions on a very granular level, helping to see the difference between “ideas” and “actions”.

Aim: To provide an opportunity to discuss which level of granularity actions should have and how the output obtained from a CPS exercise could be fed into existing project management tools and templates, helping to drive the implementation on a business level.

The next section will shed some light on the content and tools that were included in the training in order to include the topic of metacognition into the training.

Metacognition Toolkit

As described in the literature section, metacognition is seen as a way of enabling the learner to employ and use new skills in a deliberate, purposeful way, allowing him to accelerate the learning progress. Empowering participants to speed up their learning process and encouraging them to reflect on the use of their new skillset within their everyday environment and tasks was the precisely the objective when including metacognition into the training.

The research highlighted three important areas to be covered: the introduction of metacognition to the participants, the identification of strategies within the learning context (metacognitive knowledge), and the regulation of their implementation (metacognitive regulation).

These three areas formed the backbone of the metacognition instruction in the training, including both theoretical information and practical tools. The table below provides an overview of all the collateral that has been developed to accompany the metacognition instruction; more detail is to be found in Appendix C.

Table 2

Elements of the Metacognition Toolkit

Material	Description
Modeling Strategies within CPS instruction	A list with several examples of behaviors that the trainer explicitly models in the early phase of the CPS instruction in order to facilitate strategy identification later on
Examples for non-CPS strategies	Three examples from two different fields that helps explain the concept of strategies outside a CPS context
Strategy Evaluation Matrix Worksheet	A blank worksheet for a group or an individual to use in building metacognitive knowledge
Questions to prompt	A list of trainer questions to help participants (1) discover,

Strategy Identification	(2) discuss and (3) clearly phrase strategies
Example to help distinguish differences between strategies and tools	A list of observations regarding the confusion of CPS strategies and tools and one example for explaining the difference between strategies and tools
Examples for commonly identified creative problem solving strategies	An overview of some strategies that have been readily identified within trainings
Regulatory Checklist Worksheet	A pre-populated worksheet for group or individual use to foster metacognitive regulation
Modeling and prompting checklist use	A list of questions that the trainer can ask to encourage metacognitive regulation – even before introducing a Regulatory Checklist

As apparent in the training agenda, the introduction to metacognition as a topic happened early on, almost as part of the expectation setting. In this first very short, theoretical introduction, the possible benefits of metacognition were explained and the motivation behind including this topic into the training was discussed. The two subsequent areas, metacognitive knowledge and metacognitive regulation, were briefly mentioned to participants. More examples were given and discussed when the participants indicated interest or need for clarification.

In order to cover the areas of metacognitive knowledge and regulation, research suggests that there are two specific tools that can help make these areas tangible. These tools are the Strategy Evaluation Matrix and Regulatory Checklist, as discussed earlier in the literature section. A practical, tool-based approach with time for group discussion and reflection therefore arose for this training, based on the benefits of scaffolded instruction and

cooperative learning. An important element of this scaffolded instruction is for the trainer to model and exemplify those behaviors and attitudes, which will later become the building blocks of the metacognitive strategies that participants will identify. Examples for this are given in Appendix C.

In order to cover and explore the area of metacognitive knowledge, the participants were first introduced to the Strategy Evaluation Matrix (SEM) in the form of an empty worksheet (see Table 3 for the layout of a SEM including an example of a strategy). The worksheet was handed out after a number of CPS tools had already been covered. This is necessary as participants will require some experience with a given, cognitive process before they can start to derive metacognitive strategies linked to it.

Table 3

Layout of a Strategy Evaluation Matrix including an example from the field of reading comprehension

Strategy	How to use it	When to use it	Why use it
Highlighting text	Pause after each paragraph, quiz yourself in order to identify important information; then highlight it in the text	When you feel unable to recall information about the text you have read	To improve reading comprehension of (complex or larger) sections of text or make summarizing easier

Examples for metacognitive strategies that can be applied for trouble-shooting other cognitive processes (reading comprehension; handwriting) were given in order to explain the concept of a metacognitive strategy. If required, questions from participants were addressed and the difference between strategies and tools were clarified (see Appendix C for examples on strategies and the difference between strategy and tools). Using prompts from the trainer (see Appendix C), the participants then explored and shared their observations about common behaviors, which led to the identification of strategies. The trainer helped to clarify and took

notes on the flipchart, which remained visible throughout the session. Displaying the SEM flipchart throughout the training is advisable in order to remind participants to employ strategies as they progress through later stages of the CPS process.

New strategies may be added to the flipchart throughout the remainder of the training, while the trainer continued to exemplify strategy use and supported participants to reflect on strategy application. In this way, the trainer models and anticipates what will be introduced to participants towards the last third of the training – the Regulatory Checklist. This checklist contains a number of questions regarding all stages of strategy use – namely the planning, monitoring and evaluating of strategies.

In order to explicitly introduce this checklist, participants are handed a pre-populated checklist worksheet that contains guiding questions to support and enforce strategy use (see Figure 2).

The checklist was discussed in the group, and participants were encouraged to employ the checklist during the course of the training (and reminded to do so by the trainer).

In order to create a better understanding amongst participants why metacognition was included in the training, the experience of metacognitive instruction was debriefed at the end of the training. Participants were particularly requested to ask any open questions and discuss possible benefits of metacognition instruction and their future use of strategies.

As the trainer, I found it interesting to contrast learning experiences from groups and individuals who have been exposed to metacognition instruction with those who haven't, and have shared these observations with participants in order to increase their motivation to use these additional metacognition tools.

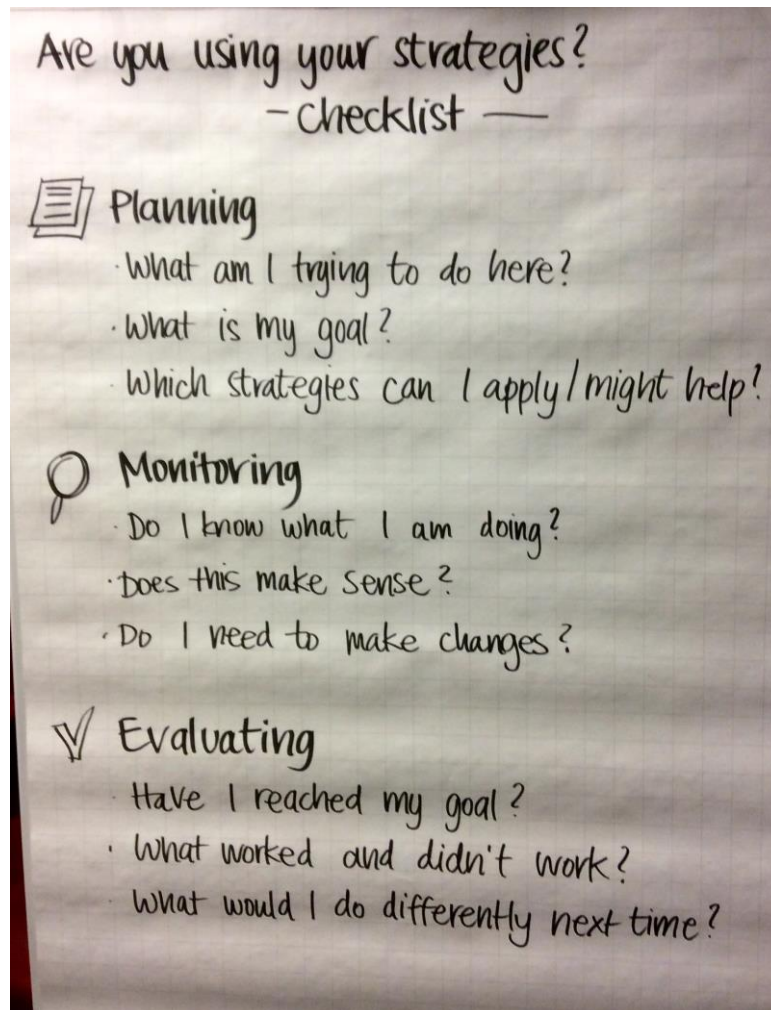


Figure 2. The Regulatory Checklist used in the face-to-face training; adapted from Schraw (1998) and King (1991).

Section 5 will provide a detailed insight into my takeaways from the overall training design, in particular the inclusion of metacognitive elements.

SECTION FIVE: KEY LEARNINGS

Throughout the implementation of this project, there were several major areas of learning. This section summarizes my learning made within the areas of training design and content, training delivery and all insights derived from the inclusion of metacognition instruction.

Training Agenda: Design and Content

This was not the first training I have designed; in fact, I have been regularly involved in training design over the last 5 years, both when designing training around my area of expertise and when consulting others. I have been exposed to general training theories such as accelerated learning (Meier, 2000) and also specific approaches that have their home in the creative field, for example the Torrance Incubation Model (Torrance & Safter, 1990).

My main learning in this project was to focus on a good balance between trainer input and participant activity. I wanted to ensure that participants received enough time to get actively involved, but also to critically reflect on the content.

My impression was that the opportunity to work on a personal topic – and make visible progress on it – was a huge motivating factor for the participants. One participant mentioned her perception of the training as a “personal and enjoyable journey” (E. Koh, personal communication, November 23, 2017). The quality and depth of questions asked by the participants throughout the training seemed to confirm this. As a trainer, the fact that I was able to switch roles between trainer, facilitator and creativity expert kept my energy levels high.

Training Delivery: Virtual and Face-to-Face

Although both trainings covered the same content, the delivery mode played a huge part in both the participants’ and my own experience.

During the pilot phase, the first training interactions all happened to be initial meetings for the virtual trainings; the first face-to-face pilot session only took place when the first of

the virtual training participants had already reached session 3 or 4. For this face-to-face pilot, we had agreed to split the training over two afternoons, aiming for ca 8-9 hours of training time.

It was then that I had to learn the hard way that the face-to-face delivery cannot provide the same depth of trainer involvement, amount of content and tools covered, and personal problem solving as the virtual setup. Indeed, after 8 hours had passed we were still far away from finishing the training (on the plus side, the participants had made huge progress on the personal topics they had brought into the training – which by this time felt more like personal coaching).

While I wasn't happy to compromise on trainer involvement and content covered, I realized that the face-to-face training needed to have much stricter time boxes in which groups or individuals would practice the tools. Interestingly, this was really hard for me to implement, since I would have preferred to give everybody the powerful experience of solving a personal, complex problem using CPS – rather than just scratching the surface due to lack of time.

In the end, I settled on a new understanding; while applying the tools is useful for learning about CPS, I wasn't going to turn people into CPS practitioners within just one full-day session. Rather, I wanted to make sure that they had plenty of time to understand the general logic and the heartbeat of divergent and convergent thinking, as well as some of the attitudes and behaviors (and strategies!) that are key to creative thinking. One example for this was to reconsider the tool selection and include a warm-up activity in the ideation phase, in order to focus on behaviors and attitudes.

Another complexity in the face-to-face training was the fact that it was difficult (at times impossible) to monitor the progress or struggle of individual participants, if they didn't voice any questions or concerns. This was mitigated by the fact that I was working very

closely with a very small group of participants, and it has confirmed that this is how I would like to run this training in the future.

These insights from the face-to-face training eventually led to an adaption in the virtual training context: I encouraged participants to choose – whenever this made sense – if they preferred to explore the full depth of a tool, or if they would rather try out a multitude of tools in less detail. This has allowed me to make the training experience even more bespoke for different virtual training participants, while still allowing us to stick with the overall agenda.

Finally, while the face-to-face training is an intense experience, the virtual trainings can also be tough. On more than one occasion I was faced with an individual who had lost focus or was having a bad day, making it an extremely difficult trainer experience. Other participants tended to cancel our virtual appointments at very short notice: I actually preferred this to working with someone who is distracted. A general conclusion seems to be that the more opportunity for real application an individual sees for this toolset, the more they are able to concentrate and commit to the training setup.

Metacognition: Instructions and Tools

Some of the biggest personal learning and insight within this project came from the inclusion of metacognition into the training.

A general and straightforward takeaway is the fact that close attention needs to be paid to the purpose and length of the training, and to the needs of the target audience. The latter element will be helpful to understand how metacognition should be introduced, the former to decide how much and to which level of detail.

The participant feedback suggested that at first the term “metacognition” sounds complicated and uninviting. I therefore adapted the language and started to use the term “thinking about your thinking” when introducing metacognition. Similarly, I rephrased

metacognitive knowledge as “strategies for creativity” and metacognitive regulation as “checking the use of your strategies”. This led to a much higher acceptance for the content around metacognition, and allowed me to introduce the actual terminology at a later point.

Trying to include metacognition into an 8-hour training brought some restrictions around how much time could be spent on the topic; if I had to run shorter or longer trainings, I would re-evaluate the amount of time spent on metacognitive instruction. Interestingly, the participants seemed to go through a journey regarding their appreciation of the topic; while they sometimes started out as being interested but not fully convinced of the benefits of discussing the topic, their appreciation for it seemed to grow during the training as it became more explicit and tangible. Remarkably, follow-up discussions conducted up to two weeks after the training indicated that participants now fully appreciated why metacognition was included in the training – that it allowed them to apply the new thinking outside of the training environment.

An interesting point regarding the process of teaching metacognition is the role of the trainer. I found myself adapting my training and teaching style so that I would be able to consciously model behaviors, attitudes and thus strategies (for example divergent and convergent thinking; questioning techniques; deferring judgment) before explicitly talking about them. This appears to have made it easier for participants to subsequently identify strategies when prompted to do so – I have the impression that modeling strategies throughout the earlier parts of the training also allows the learner to formulate them more specifically and to distinguish between strategies more clearly.

I have noted a few important actions that the trainer can take to further facilitate this, such as employing an open-ended questioning technique when probing for strategies; being open for all input from participants and gently helping to clarify or guide the formulation of strategies; and provide examples to help distinguish between strategies and tools (see Appendix C).

Perhaps not surprisingly, I made the observation that individuals who have a background in training or facilitation seem to approach metacognitive knowledge and regulation more easily and naturally; they generally seem to identify strategies without much prompting and are more conscious to their application.

Table 4

Readily identified Creative Problem Solving Strategies across different trainings

Strategy	How to use it	When	Why
Asking questions	Ask lots of open-ended questions to encourage sharing of information but also reflection or decision making	In every divergent thinking phase	To discover more content, the truth, key data
Letting thoughts flow (deferring judgement)	Don't interrupt the flow of thoughts with criticism or negative feedback; think out loud	Whenever it seems difficult to allow oneself or others to express thoughts/ideas	Get more diversity and also positive interaction in a team
Following the flow of divergent and convergent thinking	Check if you are still following the natural rhythm of divergent and convergent thinking; consciously consider if you have diverged enough	Whenever you seek to come up with new content	To really ensure divergence before closing down on choices again
Using positive words (affirmative judgement)	Use strong, positive, powerful words when phrasing input such as ideas but also feedback	always	To maintain a positive attitude, outlook and interaction
Keeping open (tolerating ambiguity)	Remind yourself not to struggle when immediate solutions are not visible	If you notice that there seems to be a risk of rushing or closing down	Work diligently through different thinking phases rather than rushing it

When comparing strategies across the different groups and individuals, it becomes obvious that the strategies identified are very similar (see Table 4). This is noteworthy especially since the identification of strategies was facilitated in an open-ended way without specific guidance by the trainer. All groups or individuals readily identified especially the strategies of “diverging”, “asking questions” and “using positive words”. It is also interesting to see that these strategies really reflect a mix of behaviors, attitudes and affective skills

commonly employed and referenced in the relevant literature (Puccio et al., 2010). To me this highlights that only the combination of these aspects really makes up the difference between the routines of business thinking and the approach that Creative Problem Solving offers. On the other hand, it can of course be expected that the trainers' style of facilitating might influence which strategies participants can identify – what isn't modeled by the trainer does not get reflected in the SEM. This important point is also discussed in the final section in order to find ways to mitigate this bias.

The most affirming aspect of the metacognitive instruction was that after the Strategy Evaluation Matrix had been populated, all participants very readily used the strategies as a reference point for the remainder of the training. In some instances, participants vocalized which strategies they were currently using (or, when stuck on a tool, which strategies they might use to get unstuck). In addition, the group started to build a language around the strategies, constantly referring to them and consequently building on and linking into the other semantics and phrasing that CPS offers.

In closing, the metacognitive instruction has proven to be a worthwhile addition to the training setup, providing great stimulus for applying the new strategies outside the training environment. I found that this could even be accelerated by encouraging participants to think about how existing business tools (SWOT, Fishbone Diagram, etc.) could be adapted or used according to the creative thinking strategies identified in the training. In future trainings I will consider including more time for both building metacognitive knowledge and training metacognitive regulation, whenever the timing allows to do so.

Table 5

Personal learning from metacognitive instruction – the perspective of the trainer

Construct	Learning
Introducing Metacognition	<ul style="list-style-type: none"> • Needs to be introduced within the planned training setup rather than as an afterthought (although from experience this is possible for very motivated individuals, particularly if they seek to apply CPS for example as part of their facilitation toolkit) • Needs to take into account the maturity, motivation and capability of the target audience
Metacognitive Knowledge	<ul style="list-style-type: none"> • Consider using different wording, i.e. “Strategies for Creativity” to make the topic more approachable • Accelerate the identification of strategies by consciously modeling them throughout early parts of the training • Use an open-ended questioning technique to encourage participant discussion when seeking to identify strategies • Be flexible with the strategy names used by participants in order to create feeling of ownership of strategies • Provide examples to help distinguish between strategies and tools • Use a follow-up meeting or call to add additional strategies participants have come up with
Metacognitive Regulation	<ul style="list-style-type: none"> • Separate metacognitive knowledge and regulation in order to allow for more practice and avoid overload • Begin to prompt reflection of strategy use as soon as first strategies are identified • Consider to draft metacognitive checklist together with participants if time allows
General advice	<ul style="list-style-type: none"> • Should only be included in trainings where it is possible to

	dedicate a relevant amount of time to the topic; personal estimate including all sections: min. 1.5 hrs
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The last section will provide a conclusion of this project, including an outlook over possible next steps.

SECTION SIX: CONCLUSION

Evaluation of the project

Although this project was relatively short-term, it has provided me with some great opportunities for personal learning and growth. A full POINT can be found in Appendix E. I am confident that I have reached all the objectives I set for myself. I have developed a flexible training framework that, while building off the same agenda, can be used in different delivery modes. The tools included can be easily adapted to fit the needs of participants and to suit overall training length. Particularly, the metacognitive instruction helped participants to focus on the logic and semantics of the CPS approach, creating a common language and helping participants to remind each other of good behaviors.

I have deepened my knowledge about metacognition, inside and outside of the context of creativity. I have explored a number of possible approaches to support or enhance the development of metacognition, tested a number of them and made personal conclusions on the applicability within the training. Participant feedback indicated that this element has been useful for them and has helped to transfer their learning into the real world:

- On more than one occasion, participants were able to identify additional new strategies even after the training (“I see new strategies coming up, such as ‘staying at ease (tolerating ambiguity)’ ” (I. Lindt, personal communication, November 7, 2017).
- Beyond that, participants reported that they had acquired a new, more holistic approach to problem solving, particularly around the element of clarification (“There is more to solving a problem than just finding a quick solution”; “I think the value lies in the clarification stage” – I. Lindt and R. Kubbe, personal communication, November 7, 2017)

- Several participants found themselves able to immediately leverage the new tools and strategies and started implementing changes (in the case of the virtual trainings, even while training was still running).

I also witnessed my own progress towards becoming a better creative leader. One of my goals was to unlock options for my future career and development. The project has helped to establish connections with other parts of the business and to meet key stakeholders and multipliers who I would otherwise not have had access to. In addition, their appreciation of the training has given me exposure to some of the most senior leaders of the company, as well as access to events that I wouldn't have been invited to before.

I built relationships with parties who are interested in continuing this training once I return from my maternity leave, which might allow me to explore alternative career options should my current role profile change after my return. Partly due to the physical constraints that I have experienced during pregnancy, I have developed additional facilitation skills. As an example, I have been calmer during training facilitation, becoming more accommodating and less stressed by small complications, which had a positive impact on my training delivery which was previously very high-energy and therefore exhausting for me. In addition, I had the opportunity to practice the delivery of some tools that were relatively new to me, making me increasingly confident and comfortable and improving the way in which I instructed and explained tool use.

In many ways, delivering this project has been a culminating experience for this Masters Degree, allowing me to establish myself as a subject matter expert. Finally, this project embodies a training subject that I had wanted to deliver to the organization for a long time – while the demand and acceptance in the organization was lacking before, this was the perfect time to implement the training.

What I see myself doing next is spreading my experience within the creative community, but also applying the new insights to facilitate ongoing organizational change.

Regarding the first point, I plan to visually summarize my findings on metacognition and CPS so I can take them to the CREA conference next year, where I will seek supporters for the topic as a possible immersion to be held the following year. I also plan to submit an EXPO on Metacognition for CREA 2018 that is geared towards new CPS practitioners, but also open to experienced trainers or facilitators. It would be interesting to review the metacognitive strategies identified in this training with other trainers in order to verify them and possibly extend this list in order to balance any bias in strategy identification that might have been caused by my individual facilitation style.

Regarding the further implementation of this topic in my role and in my work environment, I see a great opportunity to pursue this topic after I return from maternity leave. The new connections I have made in different parts of the company led me to feel more in control of the future role I might like to take up - possibly leaving the one I had for the last 5 years in order to better focus on creativity as a new skill in the company. Several future trainings have already been requested, and I would like to explore how the one piloted here could be adapted for other audiences and target groups. In particular, I would like to embed FourSight deeper into the training; iterate the training approach for use with people from an operational background and to seek opportunities for a longer training.

References

- Ackoff, R. L., & Vergara, E. (1988). Creativity in problem solving and planning. In R.L. Kuhn (Ed.), *Handbook for creative and innovative managers*, (pp. 77-89). New York, NY: McGraw-Hill.
- Anderson, N. J. (2002, April). The role of metacognition in second language teaching and learning. CAL Digest. Retrieved from www.cal.org/resources/digest/0110anderson.html
- Apaydin, M., & Hossary, M. (2017). Achieving metacognition through cognitive strategy instruction. *International Journal of Educational Management*, 31(6), 696-717.
- Armbruster, B. B. (1989). Metacognition in creativity. In Glover, J. A., Ronning, R. R., & Reynolds, C. (Eds.), *Handbook of creativity* (pp. 177-182). New York, NY: Springer.
- Baker, L. (1989). Metacognition, comprehension monitoring, and the adult reader. *Educational Psychology Review*, 1, 3–38.
- Baker, L., & Brown, A. L. (1984). Metacognitive skills and reading. *Handbook of reading research*, 1(353), V394.
- Brown, A. (1987). Metacognition, executive control, self-regulation, and other mysterious mechanisms. In F. E. Weinert & R. H. Kluwe (Eds.), *Metacognition, motivation, and understanding* (pp. 65–116). Hillsdale, NJ: Erlbaum.
- Delclos, V.R., & Harrington, C. (1991). Effects of strategy monitoring and proactive instruction on children's problem-solving performance. *Journal of Educational Psychology*, 83, 35–42.
- Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data*. Cambridge, MA: MIT Press.
- Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence* (pp. 231–236). Hillsdale, NJ: Erlbaum.
- Flavell, H. (1979). Metacognition and cognitive monitoring: a new era of cognitive developmental inquiry. *The American Psychologist*, 34, 906–911.

- Garner, R. (1987). *Metacognition and Reading Comprehension*. Norwood, NJ: Ablex Publishing.
- Goldstein, K. (1940). *Human nature in the light of psychotherapy*. Cambridge, UK: Harvard University Press.
- Gordon, W. J. (1961). *Synectics*. New York, NY: Harper and Row Publishers.
- Hargrove, R.A., & Nietfeld, J.L. (2015). The impact of metacognitive instruction on creative problem solving. *The Journal of Experimental Education*, 83(3), 291-318.
- Hartman, H., & Sternberg, R. J. (1992). A broad BACEIS for improving thinking. *Instructional Science*, 21(5), 401-425.
- King, A. (1991). Effects of training in strategic questioning on children's problem-solving performance. *Journal of Educational Psychology*, 83(3), 307-317.
- Ku, K. Y. L., & Ho, I. T. (2010). Metacognitive strategies that enhance critical thinking. *Metacognition and Learning*, 5(3), 251-267.
- Livingston, J. A. (1997). Metacognition: An Overview. Retrieved from <http://www.gse.buffalo.edu/fas/shuell/CEP564/Metacog.html> at 08.11.2017
- Maslow, A. H. (1968). *Toward a psychology of being*. New York, NY: Wiley.
- Maslow, A. H., Frager, R., & Fadiman, J. (1970). *Motivation and personality*. New York, NY: Harper & Row.
- Meier, D. (2000). *The accelerated learning handbook: A creative guide to designing and delivering faster, more effective training programs*. New York, NY: McGraw Hill Professional.
- Osborn, A. (2013a, February 9). *Forced connection and brainstorm tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=uv0-bJ5FEvo>
- Osborn, A. (2013b, February 13). *Highlighting tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=MN4DoWEQDgg>

- Osborn, A. (2013c, February 13). *PPCO tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=N2mZfQOWPls>
- Osborn, A. (2013d, February 13). *Stakeholder analysis tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=fYatFyQ6XxY>
- Osborn, A. (2013e, February 13). *Targeting tool facilitation* [Video File]. Retrieved from https://www.youtube.com/watch?v=ipc1k_ALmk0
- Osborn, A. (2013f, February 13). *Why whats stopping you tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=YPEnfIXC8do>
- Osborn, A. (2013g, February 25). *Brainwriting & brainstorming tool facilitation* [Video File]. Retrieved from <https://www.youtube.com/watch?v=TCEOWOpSWl0>
- Paris, S. G., & Winograd, P. (1990). Promoting metacognition and motivation of exceptional children. *Remedial and special Education, 11*(6), 7-15.
- Puccio, G. J. (2002). *Your thinking profile: A tool for innovation*. Evanston, IL: THinc Communications
- Puccio, G. J., Mance, M., & Murdock, M. C. (2010). *Creative leadership: Skills that drive change*. Thousand Oaks, CA: Sage Publications.
- Randall, A., Fairbanks, M. M., & Kennedy, M. L. (1986). Using think-aloud protocols diagnostically with college readers. *Read. Res. Instruct, 25*, 240-253.
- Rickey, D., & Stacy, A. M. (2000). The role of metacognition in learning chemistry. *Journal of Chemical Education, 77*(7), 915-920.
- Schoenfeld, A. H. (1985). *Mathematical problem-solving*. San Diego, CA: Academic Press
- Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science, 26*(1/2), 113-125.
- Schraw, G., & Moshman, D. (1995). Metacognitive theories. *Educational Psychology Review, 7*, 351-373.

Tanner, K.D. (2012). Promoting student metacognition. *CBE – Life Sciences Education*, 11(2), 113-120.

Torrance, E. P., & Safter, H. T. (1990). *The incubation model of teaching: Getting beyond the aha!*. New York, NY: Bearly Limited.

APPENDIX A: CPS TRAINING AGENDA

Phase	Time	Topic	Content	Material
Setting the scene	00:15	Welcome and Introductions		Hand out workbooks, pens, post-it (blue)
	00:20	Introduction to creativity as a topic and the CPS framework	<ul style="list-style-type: none"> - creativity as a 21st century skill - in this context: creativity as an approach to solve complex, ill-defined problems in a structured way: cognitive, rational, semantic creativity - CPS as longest-standing, academically researched approach, which a lot of other approaches build on; a framework that can help to gain an overarching view on creativity as a process but is also open for additional tools - brief explanation of the entire process - already highlight flow of divergent and convergent thinking - two assumptions: Everyone is creative // Creative thinking skills can be learned and taught. 	CPS Poster and CPS postcard or notebook with CPS process
Clarify	00:15	Meta-cognition	<ul style="list-style-type: none"> - introduce the concept of metacognition - thinking about one's thinking: what are the strategies you can start to use when trying to think more creatively - what can you do when you get stuck in old habits? We will distinguish between two different areas: strategies for creativity (metacognitive knowledge) and reflecting on how well we are using these strategies (metacognitive regulation). Explain benefits of including metacognition into the training: Becoming more aware of creative thinking strategies and more fluent in avoiding habitual thinking 	Metacognition Poster: "Strategies for Creativity" to be completed during session
	00:30	Explore the vision: Homework review	<ul style="list-style-type: none"> - check that everybody has list of goals, wishes, challenges at hand, starting with "It would be great if..." or "I wish..." - from this we are going to identify a topic that you will work on during this training, in order to make this applied and practical - in order to make sure we select a suitable topic, we will employ a tool called "3I's". - Go through 3I's one by one: Influence - immediacy- imagination - check with participants which topics are left - pick one. Participants share selected vision statements. 	Add 3I tool as post-it to the CPS Poster Phrasing: It would be great if... Tool: Brainwriting
	00:15	Gather Data	<p>In F2F training - explain the importance of gathering data and asking clarifying questions. Show "Gathering data" sample questions on flipchart. Choose one participant as example. Discuss the importance of clarifying and asking questions. Spend more time on this in virtual set-up if needed.</p> <p>"Gathering Data" sample questions:</p> <ul style="list-style-type: none"> - What is the history of this? When did it become a challenge? - Why is this a challenge? - How do you feel about it? - What is your influence? - What have you tried? - What are the success criteria? 	
	00:15	BREAK		

01:15	Formulate a challenge: Diverge	<p>Explain what happens in this phase (5 mins). Write down and give examples for 4 challenge starters. Explain the concept of a "purge". Let participants come up with some obvious translations from vision statement into challenge (5 mins). Discuss if this is easy or difficult. Explain Ladder of Abstraction; pick one participant to try out (15 mins). Demonstrate use of strong, positive words. Then pick one to demonstrate Boundary Examination (15 mins). Check: How were these two tools different? (10 mins) Give participants time to try out one tool silently (diverge - 15 mins).</p>	<p>Phrasing: Challenge starters Tools: Ladder of Abstraction; Boundary Examination</p>
	00:20	Formulate a challenge: Converge	<p>Explain again the flow between diverge and converge. Explain HITS as a tool and let participants converge in order to identify ONE challenge to go forward with. Let everyone read out the selected challenge.</p>
01:00	BREAK		
00:30	Metacognition	<p>Hand out Strategy Evaluation Matrix worksheet ("Strategies for Creativity"). Give examples what strategies are, using reading comprehension and left-handed handwriting as an example. Discuss in the group: Have you identified any recurring strategies that could help you to maintain creative thinking or get unstuck when you get stuck? Capture all input on flipchart. Ask clarifying questions. Make sure to highlight differences between strategies and tools.</p>	<p>SEM handouts (and flipchart)</p>
01:00	Explore Ideas: Diverge	<p>Explain where we are in the CPS cycle and content of ideate phase. Set up individual workspaces for participants. Everyone works on their own challenge. Start individually with a "purge" - flushing out all "obvious" ideas (5min). Introduce divergent thinking guidelines (5 mins). Practise correct brainstorming behaviour: Hippo in the bathtub (5mins). Apply this behaviour to individual challenges, in groups (2x5 mins). Introduce a tool: Forced Connections based on one picture (look at pic, collect associations, apply them to the challenge - 15 min). Mention other tools: Excursions, SES box. Use remaining time to work on other challenges (split into groups).</p>	<p>Divergent Thinking Guidelines Poster Tools: Brainstorming, Visual Forced Connections, (Excursions, SES box)</p>
		00:10	Explore Ideas: Converge
00:20	BREAK		
00:30	Metacognition	<p>Reflect: are there any new strategies you have identified? How are you doing with the existing strategies? Use Regulatory checklist if useful.</p>	<p>Regulatory checklist handout (and flipchart)</p>
00:45	Formulate Solutions	<p>Ask where we are in the CPS cycle. Explain content of develop phase. Explain phrasing: What I see myself doing is. Use POINT as a tool. Highlight how ideas in the "New Thinking" should now be much more precise and specific than in the ideate phase.</p>	<p>Phrasing: WISMDI Tool: POINT; (Targeting)</p>
00:20	Explore Acceptance	<p>Use Assisters and Resisters as tool for one participant topic. Explain tool and practise steps, but don't finish the action list. Participants get time to think about their own actions.</p>	<p>Tool: Assisters and Resisters</p>



Close

00:30 Formulate a Plan

Explain the use of How-how diagram to diverge on actions. Again highlight how actions and ideas can overlap, with actions being the more precise, granular version. Explain how to select most relevant actions. Explain link into action plan.

Tool: Action Plan and How-how diagram; (Performance Dashboard)

00:30 Reflect and close/Buffer

Answer any questions. Explain homework: How would you use a SWOT analysis in a CPS way – what might you learn from it?
Collect Feedback: KEEP/ more of. Get rid / less of. Improve/Rethink.

APPENDIX B: CPS TRAINING AGENDA – VIRTUAL

Phase	Session	Duration	Content	Use of ideafliP Platform
Setting the Scene	1	01:00	Welcome; introduction to creativity as a topic and CPS; answering any questions from the participant; introduce metacognition; explaining the "homework" of diverging on vision statements using "it would be great if".	explore functionalities of the platform (navigate, zoom, add items); trainer pre-populates the platform with a graphic showing the CPS cycle. Trainer adds post-it with phrasing "It would be great if" to Clarification stage.
Clarify	2	01:30	Debriefing the homework; administering 3I's tool to converge on statements; selecting vision statement; translation of vision statement into challenge statements using "Ladder of Abstraction". Possible homework: Translation of statements into challenge statements; converging.	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Capture all output (challenge statements) on post-its.
Clarify/Ideate	3	01:30	Debrief homework and reflect on experience; finalize "Ladder of Abstraction". Give option to explore "Boundary Examination" as additional tool. Discuss different tools. Start ideate phase with a "purge". Start using tools: Visual Forced Connection, Excursion, SES box. Possible homework: practice tools; converging.	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Trainer uses platform to share images for Forced Connections. Capture all output (challenge statements and ideas) on post-its. Trainer responsible for setting up a structured workspace with distinct work areas for all phases, also using color-coding.
Ideate	4	01:00	Debrief homework and reflect on experience. Start working on metacognition strategies. Continue to work on ideate stage; finish with converging on ideas (or do this as homework).	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Capture all output (ideas) on post-its as well as metacognitive strategies.
Develop	5	00:45	Reflection and questions, metacognition strategies; explain use of POINT. Homework: Write "What I see myself doing is..." paragraph and come up with P, O, I.	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Capture all output.
Develop	6	00:45	Debrief homework. Explain POINT/New Thinking. Explain Metacognitive Checklist and let participants plan how they want to approach "New Thinking" (tools, strategies). Homework: Write "what I NOW see myself doing is..."	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Capture all output.
Implement	7	01:30	Debrief homework. Discuss questions. Introduce "Assisters and Resisters", "Targeting" and "How-How Diagram". Close training and agree follow up to discuss last homework: How could you adapt SWOT to CPS thinking-what might be different.	Trainer uses CPS cycle to explain progress of the training. Capture phrasing and tools pertinent to the stage discussed. Capture all output.

APPENDIX C: METACOGNITION TOOLKIT

i. **Suggestions for modeling strategies within CPS tool instruction**

A great starting point for a facilitator is to consciously model behaviour which is readily displayed across multiple Creative Problem Solving tools. These are often linked to divergent and convergent thinking, and how divergence and convergence is accomplished. As an example, the facilitator might introduce and guide the participants through the tool “Ladder of Abstraction”. While doing so, he may model behaviours that help to diverge, such as

- asking questions (“What else?”; “When you say x, what do you mean by x?”; “I heard you say y, might that be an additional point?”)
- encouraging participants to let go of internal judgement (“you mentioned b, is this worth exploring further?”; “you seemed to have stopped yourself halfway through saying something, what did you want to say?”)
- helping to rephrase statements in an affirmative way, avoiding negative phrases.

Other behaviours linked to common CPS behaviours like tolerating ambiguity, avoiding premature closure or making connections could also be modeled when suitable. An example could be to ensure as a trainer to always model a “yes, and...” attitude, allowing and welcoming discussion and integrating the participants in the learning process.

“Modeling” here describes the fact that the facilitator consciously uses the opportunity to show and even draw attention to these behaviours as he exhibits them himself, making it easier for participants to identify them when witnessing them next.

ii. **Examples for non-CPS metacognitive strategies**

As described above, it can be helpful to explain what metacognitive strategies in other areas might look like in order to provide examples.

A facilitator might choose to explain one example for a strategy (for example the first one given in the table below); then the second scenario could simply be described to the participants and they might be asked to suggest suitable strategies themselves. In this way, any confusion or questions regarding the definition of strategies will get highlighted to the trainer at an early stage.

The guideline for the trainer here should be that cognitive and metacognitive strategies can overlap; remember the definition given by Livingston (1997): Cognitive strategies are used by an individual to help achieve a particular goal (e.g., reading a text), metacognitive strategies are used to support the process of reaching the goal (quizzing oneself about level of comprehension and troubleshooting the process if reading comprehension is not satisfactory).

Area	Example scenario
Reading comprehension (a)	A new reader might realize that while they have managed to make it through a section of text, they are unable to recall information about what they have read. They might decide to employ a strategy of pausing after each paragraph, quizzing themselves in order to highlight important information. In this way, they can glance over the highlighted information after reading a complex section in order to make summarizing easier.

Reading comprehension (b)	An experienced reader might realize that they skipped over passages of text, sometimes leaving them with the uncomfortable feeling that they might have missed important information. This reader might employ a strategy of noticing their puzzledness and using it as a sign to slow down or even re-read sections of text.
Left-handed handwriting	A student new to handwriting might experience that being left-handed leads to smudging over the text they just wrote. They may adapt their hand position in order to produce better legible writing whenever they encounter this problem. (Note: refer to section v of the toolset to help distinguish between strategies and tools; this example is particularly helpful for that).

iii. Strategy Evaluation Matrix Worksheet

The Strategy Evaluation Matrix Worksheet can be provided as a simple table which will be populated together with participants. Participants could be handed an empty worksheet while the trainer is capturing input on a flipchart.

Strategy	How to use it	When	Why

iv. Questions to prompt strategy identification

The questions listed below can serve as a starting point to prompt a discussion with students, enabling them to identify strategies as well as discuss them in a group to clearly phrase them.

(1) Discovering strategies

- If you think about how I facilitated these tools – what reoccurring behavior have you noticed, what did you see me do again and again?
- Is there anything that we do differently here compared with your standard problem solving approach?
- How is this process different from your everyday thinking approach?

(2) Discussing strategies

- Do the other group members agree to this – what might you want to add or change?
- How is this different from strategy x?
- Is there more to this strategy?

(3) Phrasing strategies

- What would you like me to write down?
- Where does this (what a participant just said) go in this table?
- Is this formulation clear for everybody?
- Should we split this into two items?
- Would you like me to tell/explain how this strategy would be called in CPS terms (if there is an obvious overlap and specific CPS term, such as deferring judgement).

v. Example to help distinguish differences between strategies and tools

I have observed a number of times that there can be some confusion between applying a tool and applying a strategy. It can help to highlight and clarify the difference already when introducing non-CPS strategies. The third strategy example outlined above in part ii of the toolkit (left-handed handwriting) lends itself to this discussion.

Imagine you as a trainer had asked participants for strategies that they can come up with to counteract smudging that occurs from left-handed writing. While “adjusting the hand position” or “rotate the paper” is a strategy, “using a different pen” or “use a laptop to write” is simply a change of tool.

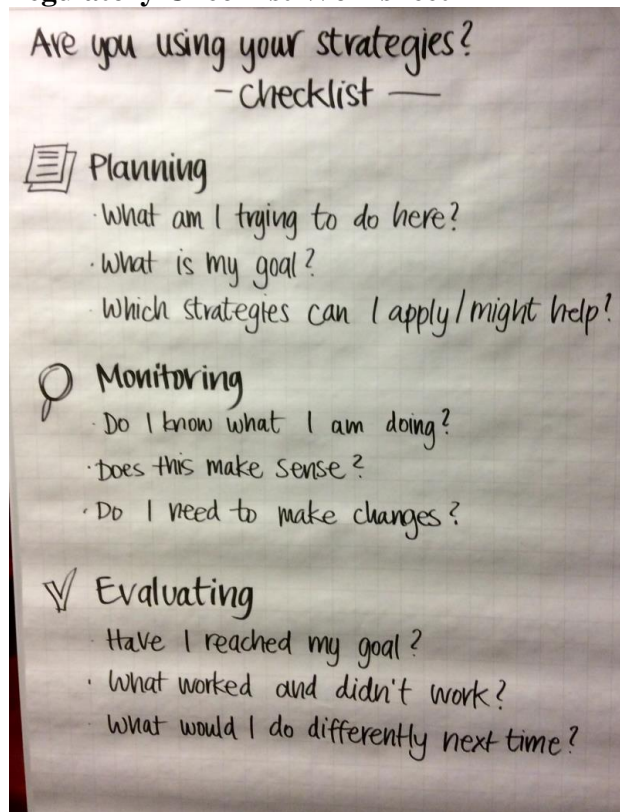
Translated to the CPS environment, “deferring judgement to come up with more, different ideas” is a strategy, “making forced connections” is using a tool.

vi. Examples for commonly identified creative problem solving strategies

This list aims to summarize which strategies groups and individuals have readily identified during the training. Phrasing in brackets suggests common CPS terms, which might not be familiar to participants but could be explained to them. For real examples from training see Appendix D.

Strategy	How to use it	When	Why
Asking questions	Ask lots of open-ended questions to encourage sharing of information but also reflection or decision making	In every divergent thinking phase	To discover more content, the truth, key data
Letting thoughts flow (deferring judgement)	Don't interrupt the flow of thoughts with criticism or negative feedback; think out loud	Whenever it seems difficult to allow oneself or others to express thoughts/ideas	Get more diversity and also positive interaction in a team
Following the flow of divergent and convergent thinking	Check if you are still following the natural rhythm of divergent and convergent thinking; consciously consider if you have diverged enough	Whenever you seek to come up with new content	To really ensure divergence before closing down on choices again
Using positive words (affirmative judgement)	Use strong, positive, powerful words when phrasing input such as ideas but also feedback	always	To maintain a positive attitude, outlook and interaction
Keeping open (tolerating ambiguity)	Remind yourself not to struggle when immediate solutions are not visible	If you notice that there seems to be a risk of rushing or closing down	Work diligently through different thinking phases rather than rushing it

vii. **Regulatory Checklist Worksheet**



viii. **Modeling and prompting checklist use**

Even before introducing the checklist, the trainer can prompt participants to think about their use of strategies. Beyond the questions that already feature as part of the checklist, the trainer could slightly rephrase and ask questions such as:

- (1) **Planning** – before an individual exercise or group work
 - What would you like to have achieved when you will complete this activity?
 - How could you approach this task?
 - How is this situation similar to another situation earlier in the process?
 - Which type of thinking or which strategies could help you here?
 - Which behavior could help you?
 - How might you find out if you get stuck?
- (2) **Monitoring** – while groups or individuals go through the activity
 - How is this going?
 - How does this feel?
 - Is there anything you could do differently to be more successful?
 - Is there anything lacking?
- (3) **Evaluating** – after the activity, also homework, has been completed
 - How did this go?
 - How did this feel?
 - What was easy or difficult for you?
 - Did this make sense?
 - What did you achieve?
 - What will you remember for next time?

APPENDIX D: EXAMPLES FOR STRATEGIES IDENTIFIED IN TRAININGS

Example 1 – First F2F Group Training, 3 participants

Strategy	How to use it	When	Why
Stop & Think	Consider the CPS cycle when you encounter a problem to know where you are	Whenever triggered by a problem/opportunity/challenge or other buzzword that reminds you of a CPS phase	Remove the blind spot of habitual thinking; be aware of your personal thinking preference
Asking questions	Ask questions until confident that you have enough info and understanding	In every divergent phase; for buy-in in convergent phase	Involving people; capture different perspectives, create common understanding
Divergent and convergent thinking	Calling it when it's missing, making yourself and others aware of it's distinct differences	<ul style="list-style-type: none"> - whenever “new thinking” is required - when there is “a problem” - when you have been stuck - multiple times, as a recurring rhythm 	Make sure you fully define and think through something; ensure you find the best solution
Defer judgement	Checking in with yourself to see if you are still open to what you are thinking and what others are saying	Whenever there are many options and a lot of discussion	To allow true divergence
Make unlikely connections*	Remove yourself from the immediate context; work with photos, analogies, roleplays	When diverging on ideas; also in clarifying	Free your mind, get alternative views

* this one probably has a cross-over with tools (which are different from strategies!) – with more experience I would have clarified and explained the difference once more to see if the group wants to rephrase this

Example 2 – Second F2F Group Training, 6 participants

Strategy	How to use it	When	Why
Go for quantity – defer judgement	Don't think too long, write down all thoughts/ items that come to mind	When diverging	Increase likelihood of new ideas
Rephrasing	Enriching your own and others' input. Being more specific and positive	Always!	To provide motivation and aspirational thinking

	regarding what you capture		
Diverge	Spend time to open your mind, let it flow, no judgement	Whenever you need to broaden/widen scope	To have enough and good input to converge
Converge	Apply positive (affirmative) judgement in order to make a selection	To provide focus and narrow it down	To make positive, meaningful, well informed choices
Asking questions	Ask questions in order to unearth valuable info and detail; “what else”, “How do you mean this”, “Can you give more information”...	Whenever you feel like you haven’t touched the core or there might be more info	To make sure you have all relevant information to move on
Trust the system	Apply the tools with rigour, wherever they may take you – choose a tool to the best of your knowledge but then trust it	Always, esp when you doubt/are stuck during tool use	Because a lot of knowledge has gone into developing the tools – benefit from it

APPENDIX E: POINT OF THE PROJECT

<p>Pluses</p> <ul style="list-style-type: none"> • the training delivery over many individual sessions allowed for an iterative approach, where observations and learnings were included immediately into the next training session – making for a very steep learning curve • the project helped me to develop skills in an important area of interest: training and coaching • The project allowed and encouraged me to link into many different groups and people spread across the business, helping to connect them and establish myself as a subject matter expert during this time of organizational transformation • I got exposed and learned about the topic of metacognition • The project challenged me to make metacognition approachable and use it to support the semantic aspect of CPS • The inclusion of metacognition also accelerated the participants’ learning as it allowed them to quickly establish a common language and facilitate their personal learning
<p>Opportunities</p> <ul style="list-style-type: none"> • Overarching: <ul style="list-style-type: none"> ○ It might have helped to create career opportunities for when I return from maternity leave ○ It might make me a more helpful teacher in future situations – ie., helping my children identify strategies rather than just “correct” answers ○ It might be possible to transfer some learnings from the metacognition instruction into other settings, for example workshops ○ It might be a great starting point for a CREA immersion workshop ○ It might be possible to also do something about metacognitive awareness, linking into other initiatives that are currently popping up in the business (i.e., mindfulness) • For the training: <ul style="list-style-type: none"> ○ It might be possible to let participants develop their own metacognitive regulation checklists – in a guided process as part of a longer training ○ It might be valuable to provide more time/space to practice planning, monitoring, evaluating metacognitive strategies – in a longer training ○ It might be worthwhile developing a booklets or handouts that is distributed after the training to help participants progress (currently, the CEF Guide is used) ○ It might be possible to develop a small-group, virtual training to allow reaching out to teams in remote locations
<p>Issues</p> <ul style="list-style-type: none"> • How to (better) weave the FourSight debriefing into the training delivery? • How to find the best balance between the theoretical “teaching” of CPS and practical “application” of the tools to a participants’ problem? • How might the training be adapted for larger groups or teams? • How to adapt this training for operational/tactical target audiences? • How to build a community that could help establish and spread this thinking in the company?

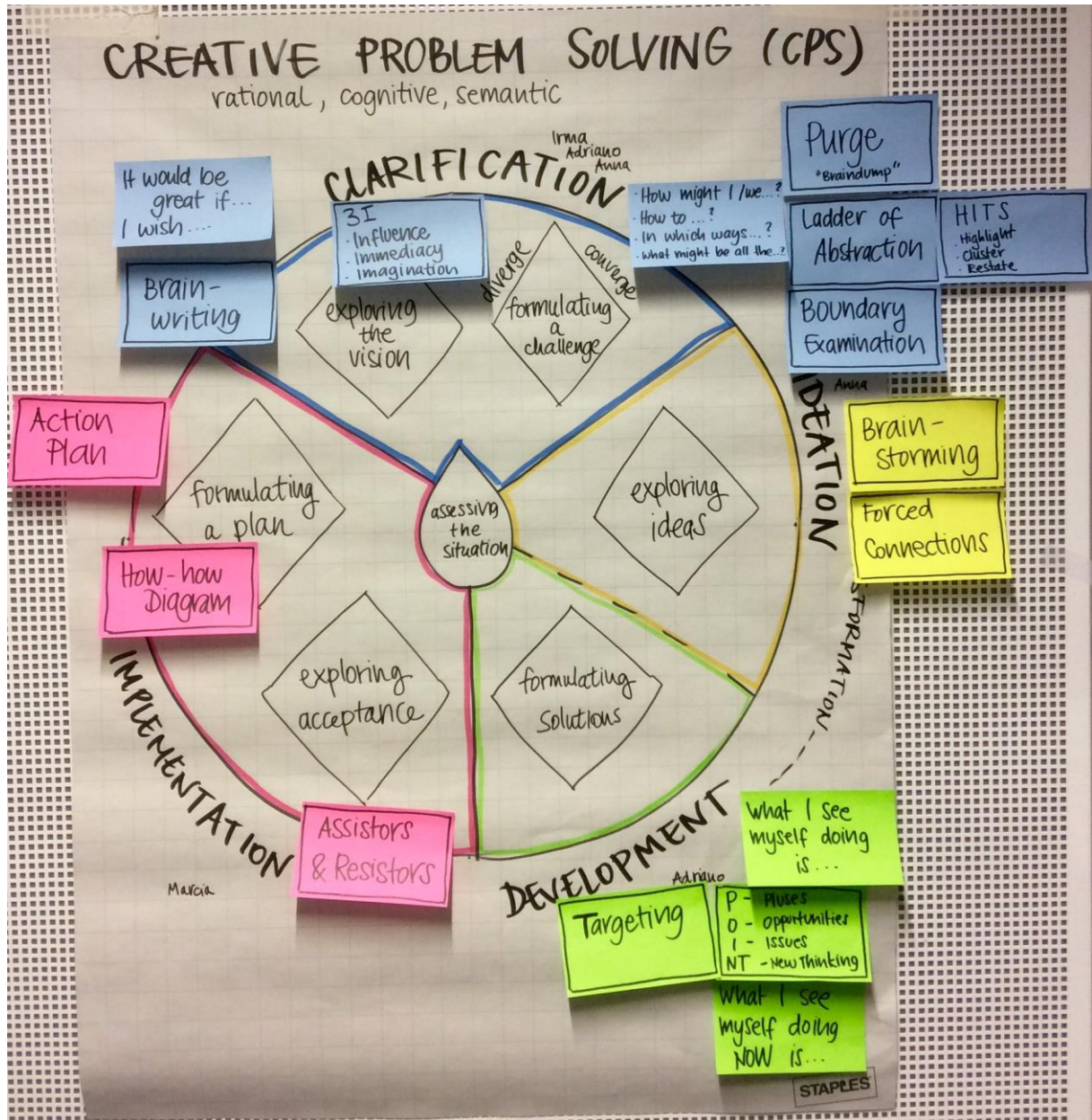
- How to ensure that I am in a position to pick this up again after maternity leave?
- How to build a CREA immersion workshop based on metacognitive instruction?

New Thinking

- How to (better) weave the FourSight debriefing into the training delivery?
 - Speak to Ingrid
 - Get a budget so I can pay for profiles
 - Make profiles a mandatory part of the training
 - Get the output in the form of a team profile
 - Make time to look at team profile before training
 - Learn more about FourSight / Get FourSight certified
 - Find out about small exercises that could be included in the training
 - Develop more material to include in the training, ie posters
 - Turn it into a game
 - Only do it for longer trainings
 - Find out about exercises that could be done as a type of pre-work
 - Make it explicit part of the delivery of tools, highlighting strengths and struggles of participants and debriefing them
- How to adapt this training for operational/tactical target audiences?
 - Understand the audience better
 - Speak to those participants who have a relevant background – Wim, Phil, Adriano
 - Only focus on the core – divergent and convergent thinking
 - Make it short
 - Hold the training in the warehouse/on the shopfloor
 - Make it part of a shift
 - Make it part of the team debriefing
 - Make it a recurring experience rather than an activity outside of work
 - It should be fun
 - Make language easier
 - Don't show a full cycle, focus on the parts that are relevant to people
 - Distinguish between shift leaders and warehouse managers vs workers
 - Pilot it with Wim
- How to build a CREA immersion workshop based on metacognitive instruction?
 - Summarize findings in a drawing before next CREA
 - Use CREA (and the drawing) to reach out to people who might be interested to co-facilitate
 - Tell Laura about it
 - Ask Izzy if she's interested
 - Start with an EXPO next year to scope out interest
 - Draw on the different backgrounds of participants during the session – ie have different working groups for education, facilitation, training etc
 - Use the entire CREA audience to identify strategies
 - Find out more about tools and try them out
 - Make it practical rather than theoretical
 - Build exercises around the identification and regulation parts

APPENDIX F: IMPRESSIONS FROM F2F TRAININGS

Example 1 – Poster created during the training, capturing CPS process and phrasing as well as tools discussed in each phase

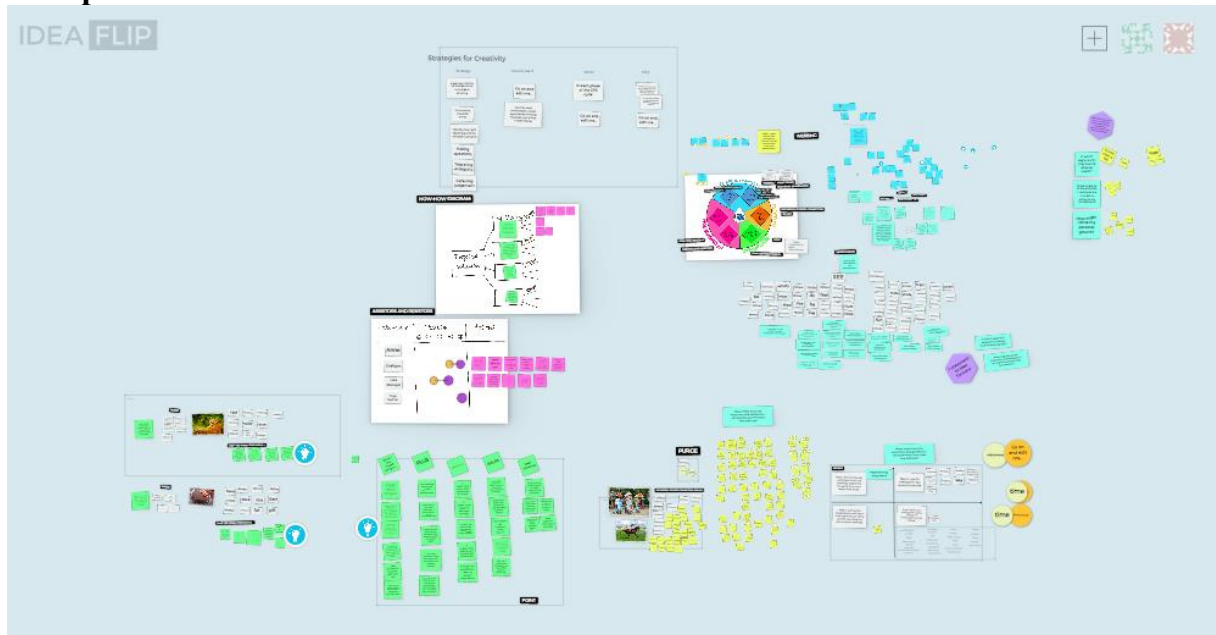


Example 2 – Face-to-Face Session

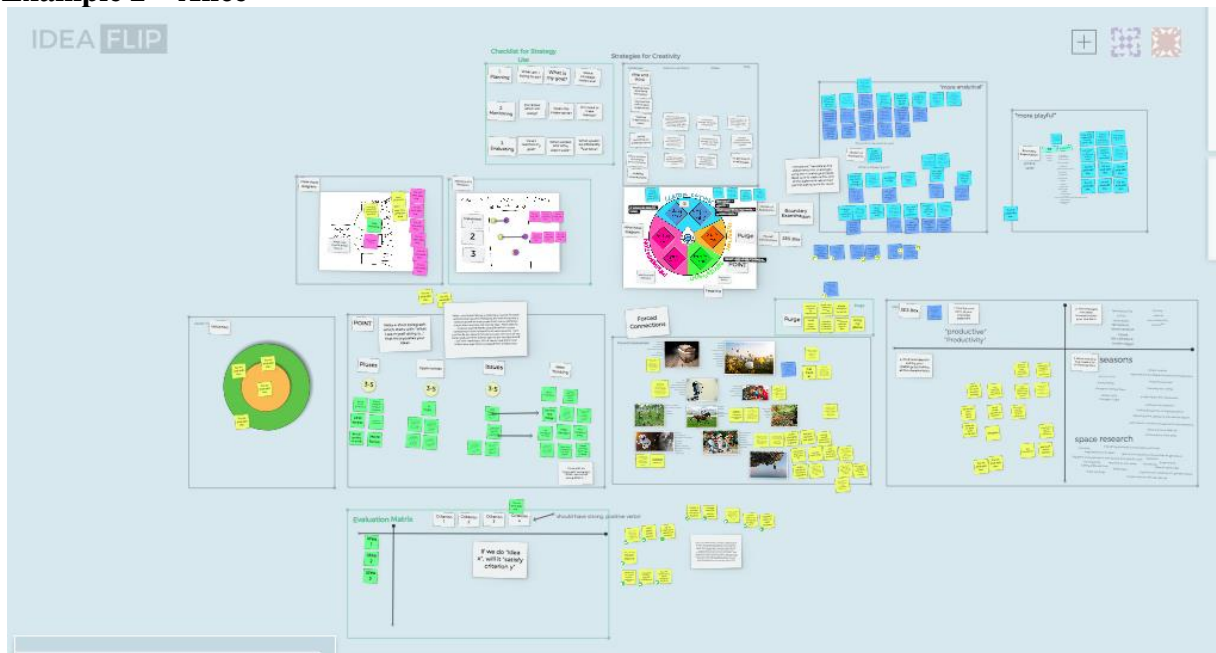


APPENDIX G: SCREENSHOTS FROM VIRTUAL TRAINING SESSIONS

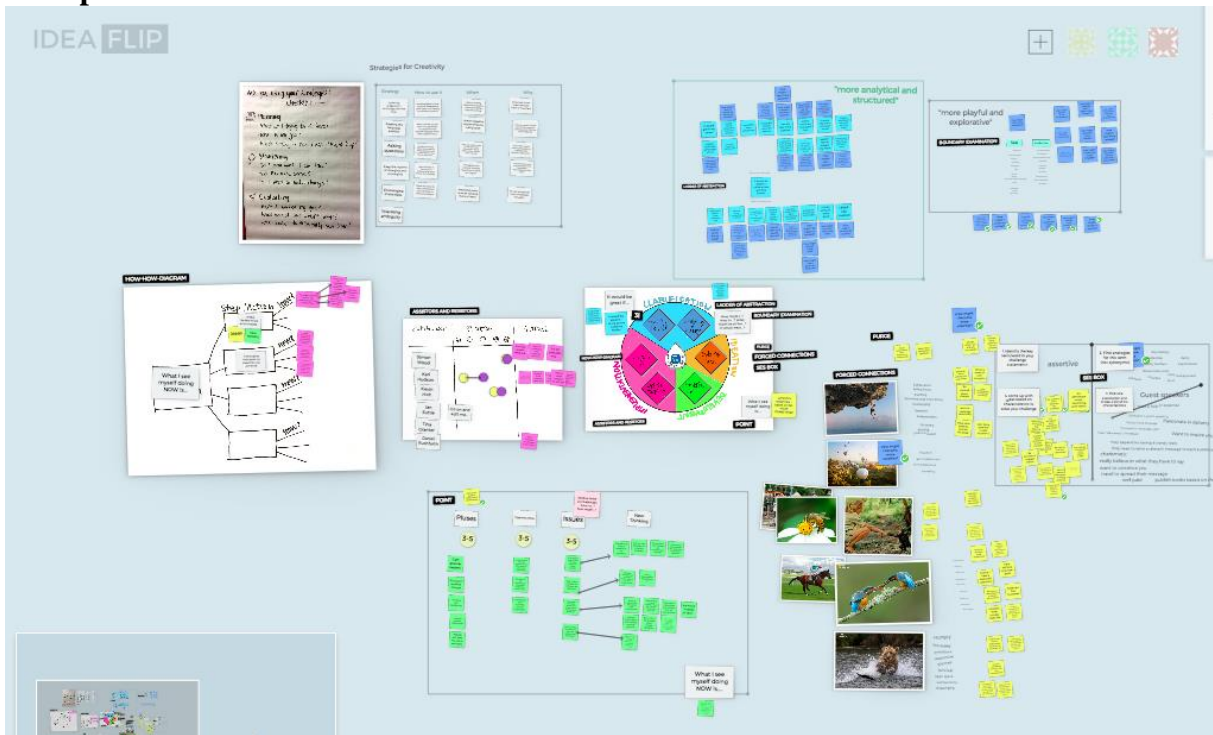
Example 1 – Anne



Example 2 – Alice



Example 3 – Coral



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I hereby grant permission to the International Center for Studies in Creativity at Buffalo State college permission to place a digital copy of this Master's Project (Fostering Metacognition in CPS Training – Tools and Techniques) as an online resource.

A. Packham

Name

6.12.2017

Date