
Future Designers: A Design Thinking Crash-Course for Children

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Abstract

'Future Designers' is an interactive and participative crash course that aims to introduce to children the concepts and practice of 'creativity', 'design', and 'design thinking'. The course targets multiple learning styles and intelligences, combining various learning approaches and tools. The full course lasts 4-5 hours and can be delivered in a single or two sessions. Up to now, five pilot studies of the course have been conducted over one year period with the objective of assessing the feasibility of the course and the attendees' satisfaction, as well as obtaining feedback. The outcomes stemming from all pilots are very promising and indicate that 'Future Designers' is an engaging and fun experience for people of diverse ages, which can fruitfully engage children (but also adults) in creative activities, and can generate interesting design ideas.

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Introduction

Design thinking represents both a way of thinking and a process that can foster creative thinking. In absolute terms, *design thinking* stands for all the cognitive processes that a person's mind goes through when performing *design*. From a more practical point of view, Tim Brown, CEO of IDEO, has (re)defined design thinking as [1], "a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity."

'Future Designers' is an interactive and participative crash course that aims to introduce to children the concepts and practice of 'creativity', 'design' and 'design thinking'. The title of the activity is purposefully ambiguous as it can be interpreted both as 'those who will become designers in the future' and 'those who will design the future'.

Future Designers Goals

- Initiate children to a way of thinking and skill which can enhance learning, solve everyday problems and improve future employment prospects and quality of work.
- Empower, boost self-confidence, inspire and spark imagination.
- Help children discover and acknowledge their ability to imagine, create and have ideas of value of their own.
- Deliver a memorable and fun intellectual and emotional experience.
- Encourage collaboration among children, children and teachers, as well as children and parents.
- Sow the first seeds towards the creation of 'micro-communities' that are supportive and rewarding of creativity.
- Provide feedback to the scientific community about how children perceive contemporary technologies and design.

The Crash Course

The Future Designers crash course is delivered by a main facilitator who is responsible for controlling the flow of the experience, lecturing and presenting, introducing and regulating the activities, prompting the children and keeping track of time¹. The course builds upon the following key elements:

1. **Surprise:** For start, children get an invitation to the activity which states that the only item they should bring is their pillow. Going to school with your pillow, is already an indication something 'extra-ordinary' will happen. Several additional surprises await children during the course.
2. **Variety:** Multiple learning styles and intelligences [7] are supported through diverse teaching and learning approaches and multi-modal digital material. Even the place and position where children seat change quite often.
3. **Cross-age appeal:** The content and activities are purposefully designed and selected to be engaging for all. In all pilots, participants of all ages, including teachers and parents, stated that they found them very stimulating and appealing.
4. **Active participation & hands-on activities:** Children are "co-drivers" of the activity and are given plenty of opportunities to actively engage individually and in groups, thus, following a 'learning by doing' constructivist approach [11] creating their own paths to knowledge. They are also free to cut-in and intervene at any time.
5. **(Team) Play & Competition:** Competitive activities are used to motivate children, but throughout them the importance of participation

¹ Additional helpers, including the children's teachers, are employed mainly to support the various activities, e.g.,

and effort are praised and winning is undervalued. Only moral - not tangible - rewards are offered (e.g., applause) to everyone. Winners get a supplementary round of applause.

6. **Humor & Fun:** As humor can promote divergent thinking [6] and a supportive atmosphere provides freedom and security in exploratory thinking [5], the course includes several opportunities that evoke children's humor and laughter. Also, when discussing the results of the activities, humor is employed to dampen criticism.
7. **Music:** Music is used in two different ways. During the hands-on activities, soft, dreamy orchestral music is played to support children's creative process and give them inspiration and new, imaginative ideas [15]. Additionally, a musical 'sting' is employed at regular intervals to punctuate interesting events and important moments (e.g., successful completion of an activity, answer to a question) and also as a cue for group 'decompression'; as long as it lasts everyone is free to stand, jump, dance, laugh, sing or shout.
8. **Imagination:** The course provides material, triggers and activities that appeal to the children's imagination rather than to their logic, to "*support and reinforce unusual ideas and responses*" [5].

The course is structured as depicted in Fig. 1. A more detailed description is provided in [8]. In essence, the Future Designers crash course tries to implement the advice provided by Torrance [16], also exploring new ways for creatively "teaching" non-traditional subjects like creativity and design. In contrast to most related

distributing materials, triggering and coaching children, making sure that everyone is participating, etc.



Figure 1: Course outline

efforts, children are explicitly taught about their ability to think creatively, so as to gain more control over it, foster creativity consciousness, demystify creativity, and increase creative ideas and products [3]. The course comprises 2 individual and 2 team activities.

Activity 1 (indiv.): Designer for a while

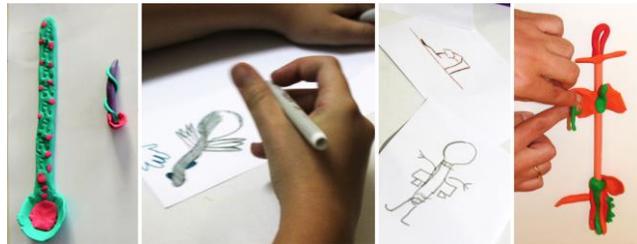


Figure 2: Designer for a while (The spoon).

Goal: Perform an act of (iterative) design through an easy first step, which is close to the children’s “zone of proximal development” [17]; introduce the concepts of design requirements and design decisions; prove to children they all have the ability to innovate.

Approach: Children are invited to design a very simple object - a spoon - using colored pens or plasticine (Fig. 2). No explicit time limit is set; the facilitator emphasizes that there will be no judgment. When everyone has finished, the facilitator (using his absentmindedness as a playful excuse) introduces, step by step, a number of design requirements (e.g., it was meant to be a teaspoon, cheap but environmentally friendly, for Tinker Bell the tiny fairy). At each step, children are asked to change their design or make a new one. In the end, the facilitator notes the pieces of

information used (who, what, why, where, preferences, cost), each yielding a different design decision. He also points out that each child has designed a unique object—although millions of spoons already exist—thus rightfully meriting the title of “designer”.

Activity 2 (indiv.): What makes me dream?



Figure 3: What makes me dream?

Goal: Reinforce the fact that children have the power to dream/imagine; reflect about what may trigger this process and discover additional triggers from peers.

Approach: Children use colored pens and Post-it notes to write and/or paint what makes them dream and imagine. Then, they stick their note on a cardboard cloud while also reading/describing its content (Fig. 3).

Activity 3 (team): The marshmallow challenge

Goal: Collaborate, communicate, and employ creative thinking to solve a predefined problem; practice learning through experimentation, failure, and iterative design.

Approach: The Marshmallow Challenge² as originally

² <http://marshmallowchallenge.com>

Pilots Participants

- Pilot 0. 8 primary school teachers, 4 post graduate students in the field of HCI, 2 children.
- Pilot 1. 12 primary school children of the 5th (~10 years old), 10 children the 6th grade (~11 years old).
- Pilot 2. 25 primary school teachers in a classroom environment.
- Pilot 3. 20 primary school children of the 5th and 6th grade, 18 parents of ages from 36 to 71.
- Pilot 4. 27 middle school children from 12 to 15 years old.

introduced by Tom Wujec is used. Children are randomly assigned to teams of three. In 18 minutes, each team must build the tallest freestanding structure out of 20 sticks of spaghetti, two meters of paper tape, 10 pieces of string, and one marshmallow (Fig. 4). At the end of the challenge, the facilitator communicates that winning is not as important as thinking creatively and having fun. Each time a team's structure is measured, everyone applauds—even in the case of failure, as failures should also be celebrated in design.

Activity 4 (team): Inventing for my school

Goal: Collaborate, communicate, and employ creative thinking to select a problem to be solved; devise an innovative solution; present it to peers; constructively assess the work of others. This activity covers all of the parts of Runco and Chand's [12] model.

Approach: The core of this activity is based on the 'Ready, Set, Design' activity³ of the Smithsonian Cooper-Hewitt, National Design Museum, but with two key additions. The first one is that children are asked to define the problem they want to solve. The reason for this is three-fold: (i) problem finding is considered an important aspect of creative thinking and behavior [2]; (ii) it can greatly help increase the intrinsic motivation of learners [13]; and (iii) one needs to know enough about a field to be able to innovate ([2]; [14]) and avoid "reinventing the wheel". The second addition is the evaluation of the inventions by the children – not the facilitator – according to several criteria, to allow them reflect on the outcomes of design and think about design strengths and weaknesses [10]. New random teams of four members are formed (Fig. 5). Their first

task is to ideate a new invention for their school, according to the following requirements: (i) the invention can be used for any purpose; (ii) it has to be used in their school (it can also be portable); (iii) it may use any kind of existing, future, or imaginative technology; (iv) nothing similar should already exist. Since there is evidence that explicit instruction can affect the novelty and value of created ideas children are asked to "be creative" and to "give ideas that no one else will think of" [9]. In the first 15 minutes, each team has to fill in an "Invention Declaration Form" comprising 5 fields: (a) invention name, (b) role / target use, (c) users, (d) place of use, and (e) first names and ages of the team members.



Figure 4: The marshmallow challenge.



Figure 5: Inventing for my school.

³ www.cooperhewitt.org/education/school-programs/designk12

Pilots Objectives

- Pilot 0. Preliminary assessment of the concept and approach, potential applicability and practical value.
- Pilot 1. "Test-drive" the course in a real setting with real learners and identify what works and what not.
- Pilot 2. Get feedback from a large number of educators about the course, including ideas, concerns and adoption potential.
- Pilot 3. Confirm the feedback from previous pilots; collect structured evaluation data; gather parents' opinions; obtain preliminary feedback about the potential of the course to engage children and adults together in creative activities.
- Pilot 4. Assess the applicability and success of the course to middle school children.

Each team receives simple materials, such as paper plates and cups, balloons, aluminum foil, and rubber bands, but not glue, tape, or scissors. Building upon Karl Duncker's "candle box experiment" for detecting "functional fixedness" [4], the prototyping materials are provided inside a paper tray but no explicit clarification is given whether this can also be used for constructing the prototype. Teams have 25 minutes to build an experimental prototype. When time is up, each team briefly presents its invention. All other teams evaluate it according to five criteria: name, originality, usefulness, ease of use, and desirability. Evaluation is rated using cardboard sheets depicting 1 to 3 light bulbs to stress that even if an idea scores low, it still remains an idea. Evaluators are challenged to justify their score and provide constructive feedback, while the team being evaluated can rebut.

Pilot Studies

Future Designers follows a learner-centred design approach, in the context of which the course is being iteratively evaluated and tested in real settings with representative stakeholders through pilot studies with complementary characteristics and goals. Up to now, the course has been tested in 5 different pilots, four of which in real school settings. All pilots were followed by two observers taking notes and pictures, and collecting spontaneous feedback. In pilots 3 and 4 user satisfaction questionnaires were also used.

Involvement in Hands-on Activities

All hands-on activities proved to be well received by participants of all ages and achieved their foreseen function and goals.

Activity 1: Designer for a While (The spoon)

The first goal of this activity was to be an act of deliberate design that everyone is able to perform. This goal was achieved 100%, as all participants successfully completed all the (re)design steps. Everybody participated and enjoyed the "reversals" which were welcomed with a very positive attitude and laughs. The second goal was to empower participants by proving that they all have the ability to innovate. This was also achieved, since most of the crafted spoons (even the ones made with plasticine) were surprisingly original. Most adults (Pilots 2 & 3) needed considerably more time to (re)design their spoons.

Activity 2: What Makes Me Dream?

This activity yielded a range of responses from primary school children (Pilots 1 & 3), all the way from simple and commonplace (e.g., "love and friendship", "the sea and the sky"), to highly imaginative or even poetic (e.g., "When you are dreaming you don't think if there is right or wrong. Every good thing has dreams, even the bad ones", "Hope for something new that we or someone else will have created"). Most of the teachers (Pilot 2) gave very simple and conventional answers comprising a short list of nouns (e.g., the sea, music, rainbows, love). Few used some verbs (when I see the rainbow, when I paint). Some drew just a minimal sketch (e.g., the sea, the sun and some flowers), or decorated their list of words with little symbols (e.g., a musical note, a heart). Most adults in Pilot 3 wrote down just a single word. In Pilot 4, children were considerably more succinct and conventional than primary school children. Only 4 of them included a minimal drawing illustrating their keyword (e.g., a smiley, some hearts, a cloud) and another 4 included a hashtag (#) in front of their keywords, a practice

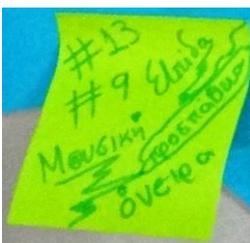
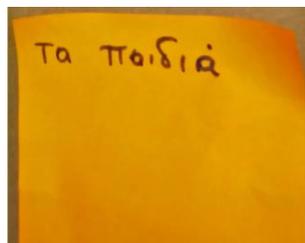


Figure 6. What makes me dream? Representative answers (top to bottom): primary school children, teachers, parents, middle school.

commonly employed in computer social networks. Fig. 6 showcases a representative post-it note from each group.

Activity 3: The Marshmallow Challenge

In accordance to evidence from the application of this activity with various audiences worldwide, the marshmallow challenge proved to be a very enjoyable and vivid experience for participants of all ages and fostered intense collaboration among group members. Depending on the age of the participants, there were considerable differences in the process followed, the model built and the success of the outcomes. In Pilot 1, all 6 teams succeeded in creating standing structures. There was considerable diversity in the type of structures created, and more than half of the teams built incremental prototypes. In Pilot 2, only one team did not succeed. In contrast to Pilot 1, all teams built the same type of pyramid-like structure and they built it in a single step without experimenting or trying to improve it. In Pilot 3, only one team of children and one of adults were not successful. Most teams of both groups relied to the pyramid-like structure. In Pilot 4, four out of nine teams did not create a standing structure. Four teams deviated from the pyramid-like structure. All teams followed an "all or nothing" approach, building a single model and sticking to it.

Activity 4: Inventing for my School

Overall, in this activity, there was diversity and little overlap among the inventions conceptualized in all Pilots. Most prototypes were creative and had aspects of novelty. Parents' prototypes were more conventional both from a conceptual and a construction point of view, followed by middle school children. Some of the teacher groups came up with very original ideas, while

a number of primary school children's' creations were totally unpredictable. In terms of collaborative spirit and skills, primary school children were the best, closely followed by teachers. Parents also did quite well, while more than half of the middle school teams faced cooperation problems. During evaluation, younger children, teachers and adults were generous with their scoring, trying to be nice to their peers. Younger children enjoyed the evaluation and were very careful in deciding scores and providing comments. Some teams had initial difficulties in reaching an agreement about the scores, but all did it in the end. Middle school children mainly scored based on personal friendships or aiming to revenge less favorable scoring by other teams.

In Pilot 1 (Fig. 7), the highest rated inventions was the *Magicoebox*, a small box that you can have in your pocket. When you open it an orange sea comes out, in which children can swim without getting wet, they can play and read, and do whatever they want without any parents around. Also, in there everything is free (e.g., restaurants, shops).

In Pilot 2 (Fig. 8), three out of six inventions were related to identifying, expressing, and turning to positive, student emotions. The invention that got the highest total score was "Grrr...Ha!Ha!Ha!" a chamber, strategically placed at the school's entrance so that everybody passes through it, that converts negative thoughts and feelings into positive ones (Fig. 8, left). Another two inventions were related to student comfortable seating.

In Pilot 3 (Fig. 9), the most highly rated invention was designed by a group of parents. It was the Interactive Desk that children can use to display books, exercises,

labs, maps, etc., and to communicate with other children. Parents' inventions were quite ordinary and meant to support the educational process, reflecting the fact that parents think of schools as a place where children go to learn. Children came up with some very imaginative inventions, like the Wish Box, a box which makes wishes come true; a Diving Simulator Room including special glasses which make their wearer see and feel as being underwater; and the Teacher's Eyes, a flying device aiding teachers to spot children that are cheating during tests.

In Pilot 4, the most highly voted invention was the Flying Book Carrier, a device to carry books and capable of recognizing children and following them. Overall, most inventions were not very innovative and, more or less, constituted adaptations of commonplace ideas.

Conclusion & Future Work

This paper has reported the experience acquired through a number of pilots of Future Designers, involving children of various ages (from 10 to 15 years), teachers and parents. The crash course has proved in practice to be a very engaging and fun experience, both for children and adults. Furthermore, it has achieved to raise interest in personal and social creativity and innovation. Despite its length and high mental and physical demands, when it ends participants (including the organizers) feel happy, motivated and full of positive energy. Stated levels of satisfaction and fun are very high for participants of all ages. Additionally, Future Designers shows promising potential as a method for collaborative design and as a source of user requirements for research projects on technology in education.



Figure 7. Indicative children's inventions from Pilot 1.



Figure 8. Indicative teachers' inventions from Pilot 2.



Figure 9. Indicative inventions from Pilot 3.

Although, up to now, digital fabrication tools have not been used, they can easily be introduced within the context of Activities 1 and 4. Of course, this means that participants should already be familiar with these tools, else additional time should be allocated for their introduction and training.

Overall, the acquired experience, although it does not provide a full validation of the Future Designers course from an education and creativity point of view, demonstrates that the course achieves its goal of widening the participant's horizon and inspiring a positive attitude towards design and creativity, by showing in practice that everybody can have good ideas, and that ideas can be showcased through simple prototypes built out of common everyday objects.

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