Report of educational activity

Title of activity	Create your own Pinball Machine
School and level	General Secondary education
Date	Feb - March 2019, 5 weeks in a row
City/Country	Antwerp, Belgium
Teaching subject	STEM
Number and age-range of students	13 pupils aged 14 years old
Working language	Dutch
Type and duration of activity	In-school activity in traditional classroom. The environment poses a challenge to perform the woodcutting and other related tasks. Duration: 5 sessions of 100 minutes, in total 500 minutes (8h)
Level of difficulty	Medium. Technical challenge was increased by working in wood and asking for a few challenging construction requirements. Also the designing phase was given extra attention.
Learning objectives	Creativity: analyzing everyday objects/games/machines and finding out how they work Technical: nderstanding what is a lever and an inclined plane from own experience Technical: Woodworking Technical: Strengths and weaknesses of different materials Technical: Fabricating wooden joints Design: Abstraction of an idea to a 2-dimensional sketch

	Desing: Trial and error / Deal with failure Social: Teamworking Social: communication Social: providing feedback on someone else idea
General description of activity	*Provide here a concise description of the educational activity with the students. If the activity is composed by multiple phases then describe each phase in more detail, mentioning what students planned, what they did, what they achieved etc. Mention also any difficulties or challenges* Details of instructions are in the workshop description (Create your own Pinball Machine). Adaptations by teacher are: 1) increased the total duration of the workshops (in total 500 minutes) . With a lot of time reserved for the brainstorming and creative phase 2) change in the central material: instead of cardboard the central material was wood here, increasing the time spent on technical works. There were also some extra requirements for the students woodwork-wise. Like they had to include at least one system containing gears.
Learning outcomes	*Give a short description of what students learned and achieved* The students showed a lot of imagination and creativity in the designing phase. Also they learned how to set realistic goals with limited time and resources available. They learned how to plan before acting, this was not a tinkering - task, they had to overthink their actions well in advance. They learned to work in group and make compromises. They learned technical woodworking skills They learned how to work out a lever using gears.
Materials or equipment that are required	*Give a list of materials or equipment that are needed for this activity* (Details see workshop description) Masking and clear tapes, strings Scissors, utility knife Hot glue gun Multi-Colored Paper Rubber bands Paper clips Straws Craft sticks, toothpick Brass fasteners

	Marbles
	Cardboard or veroboard
	Copy paper or pieces of white paper
	Shallow boxes
	Objects to decorate: googly eyes, pipe cleaners, pencils, markers, craft paper, bottle caps, aluminum foil, odds & ends.

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Interview with teachers

Questions about the classroom application

First: collecting metadata about the event
- What workshop was your application based on?
    Pinball Workshop
- Number of pupils and their level?
    13 pupils age 14y.
- Where did you execute the workshop and what was the timing?

5 weeks in a row, 11 feb-18 march 2019, always 100 min.

How did it go?
- What went well, what was difficult?

The pupils were very enthusiastic for the project. They had full commitment from the beginning to the end, and came up with a lot of creative ideas and applications. Engagement levels were high right until the end of the last week.

Difficulties were practical in nature. Groups were 3 students each, but in one of the groups the attendance of the students was very irregular, eventually with one of the students ending up alone.

Did you make changes to the material used in the workshop?
- Were there any challenges in making certain material available?

Yes, there was a focus on the material used. Pupils were obliged to work in wood, the full machine needed to be made out of wood. There were also some requirements on the construction, the pupils needed to use at least one gear system.

When you look back to the goals of your workshops/lesson, what was the most important part? The knowledge, the attitudes or the competences?

The workshop was mainly successful due to the way it is built up. There is a lot of time spent in the designing/imagining phase. Pupils don't go and start trying immediately, they dream about what it could be first, and then try to work out how they can realise that. Using materials and sources to achieve that goal

Questions about student/pupil skills

What is your expectation of the students after the class

According to you: What were the learning goals?

What are you hoping that they for sure will remember from the session? (see skill list on bottom)

How have you tried to achieve this?

Specific STEM-skills (subject-related)

- ❏ Example: Working with a laser cutter
- ❏ Example: Understanding of fluid dynamics
- ❏ ……….…
- ❏ Woodworking (sawing, drilling and filing)
- ❏ Sketching (on paper)

Transversal skills

X Willingness to learn

X Problem solving skills

X Creativity

X Ability to communicate on different levels

X Being pro-active

- ❏ Sense of entrepreneurship

X Being able to work in group

X Flexibility

- ❏ ……….…(Other)

Flexibility in the sense that they had to adapt to changes in the schedule or procedure (due to circumstances) was one of the most frequently used skill.

Which level (STEM-ladder) would you say your students have? And how have you tried to improve their level.

All of the above

What was the biggest challenge /difficulty when you look back at the class you gave?

- Describe two situations where you were confronted with a problem. What was your reaction to this problem?

There were some challenges due to the environment. It is not easy managing materials and woodcutting works in that environment.

Other challenge is the managing of all student groups at the same time, often multiple groups need your advice or help at the same time, and you cannot be there for all of them at once.

If you were allowed to choose a seminar to further develop your professional competences for these kind of applications, which course would you choose?

e.g. technically oriented (how to use equipment, tools etc)

or theoretically oriented (pedagogical methodologies)

or assessment focused (how to assess progress and skills acquired by students)

No real need for further professional development. If there should be a professional development course it should be technical, to learn how to use and apply a microcontroller

Questions about the past workshop

Which two talents or skills do you pre-possess that were useful in these workshops?

Technical skills: Woodcutting

Ability to work solution-oriented

Ability to anticipate problems students will have later on, able to help them before too much time is lost (based on experience)

If you were allowed to choose a teaching assistant for this workshop, what qualities would he or she ideally have?

A teaching assistant with organisational talent would be very useful, to help with keeping track of materials and time

According to you, what things should students definitely acquire from this workshop?

Describe also, how did you try to reach this goal?
Planning and problem solving skills

Optional: In which way differs teaching in a Fablab from teaching in a traditional classroom?

If possible, mention one or two main advantages and disadvantages in each case.

Teaching in this traditional environment (while trying to do woodcuttting work) is very frustrating as it limits the quality of work you can deliver. There will be more inaccuracies, mistakes or other errors because of the environment.

Also since the environment is classical, it does not inspire other solutions. There is no rack with materials they can go to to find inspiration to solve a problem, so they rely on the teacher more to find solutions and to think out of the box then they would probably do in a more stimulating environment

Overall, if you could change, add or improve one thing in the workshop you attended what would it be?

Being more proactive and try to avoid material waste a bit more (a lot of material was unnecessarily thrown away now)