



Bridging Theory and Practice: Utilising AI and 3D Printing in Tertiary Education

STADIO 2024 CONFERENCE

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Overview of Emerging Technologies in Education

Introduction:

AI and 3D printing are transforming education and higher education by enhancing both learning experiences and practical applications.

- AI facilitates personalised learning through tailoring content to individual student needs, making education more accessible and efficient. In research, AI supports data analysis, driving innovation and problem-solving across disciplines.
- 3D printing, on the other hand, brings abstract concepts to life, allowing students to create tangible models, especially in fields like engineering, biology, architecture and many more. It fosters creativity and hands-on learning, which enables students to prototype their ideas, experiment with designs, and better understand complex structures.

Together, AI and 3D printing are not only improving how subjects are taught but also preparing students for the evolving demands of the world of work.

STADIO Theme: Unlocking the Active RRITE Curriculum

Sub-theme: Technology-enabled Teaching and Learning in Practice

Objective of presentation: Explore AI and 3D printing in MST higher education

The Role of AI, BOTS and 3D-printing in MST Education

AI platforms are emerging as innovative tools in Mathematics, Science, and Technology education by enhancing both teaching and learning processes:

- **In mathematics:** Provide tutoring, helping students grasp complex concepts through step-by-step problem-solving, provide automated feedback, create adaptive learning paths and print manipulatives (Cheng, Antonenko, Ritzhaupt & MacFadden, 2021; Kit Ng, Tsui & Yuen, 2022). This not only allows for more tailored instruction but improved understanding.
- **In science:** Assists in simulating experiments, analysing data, and visualising abstract theories. For example, AI can model chemical reactions or biological processes, making challenging concepts more accessible and engaging. It also supports research by assisting with automating data collection and analysis, freeing up time for deeper inquiry and innovation (Cheng, Antonenko, Ritzhaupt & MacFadden, 2021; Talaat & Hassan, 2021).
- **In technology:** Introduce students to coding, robotics, and machine learning, preparing them for the digital world. They facilitate hands-on learning experiences, allowing students to experiment with algorithms, build prototypes, and understand real-world applications of AI technologies (Cheng, Antonenko, Ritzhaupt & MacFadden, 2021; AbouHashem, Dayal, Savanah & Strkalj, 2015; Talaat & Hassan, 2021).

These platforms are revolutionising STEAM education by promoting interactivity, creativity, and critical thinking.

AI, BOT and 3D-printing driven Lecture Integration

How did we go about this?

Please note that AI, BOT and 3D printing integration has been done during science lessons and practical activities on WAT from the beginning of 2024. We as lecturers saw the value, did some research and today we are sharing the information from our own viewpoint.

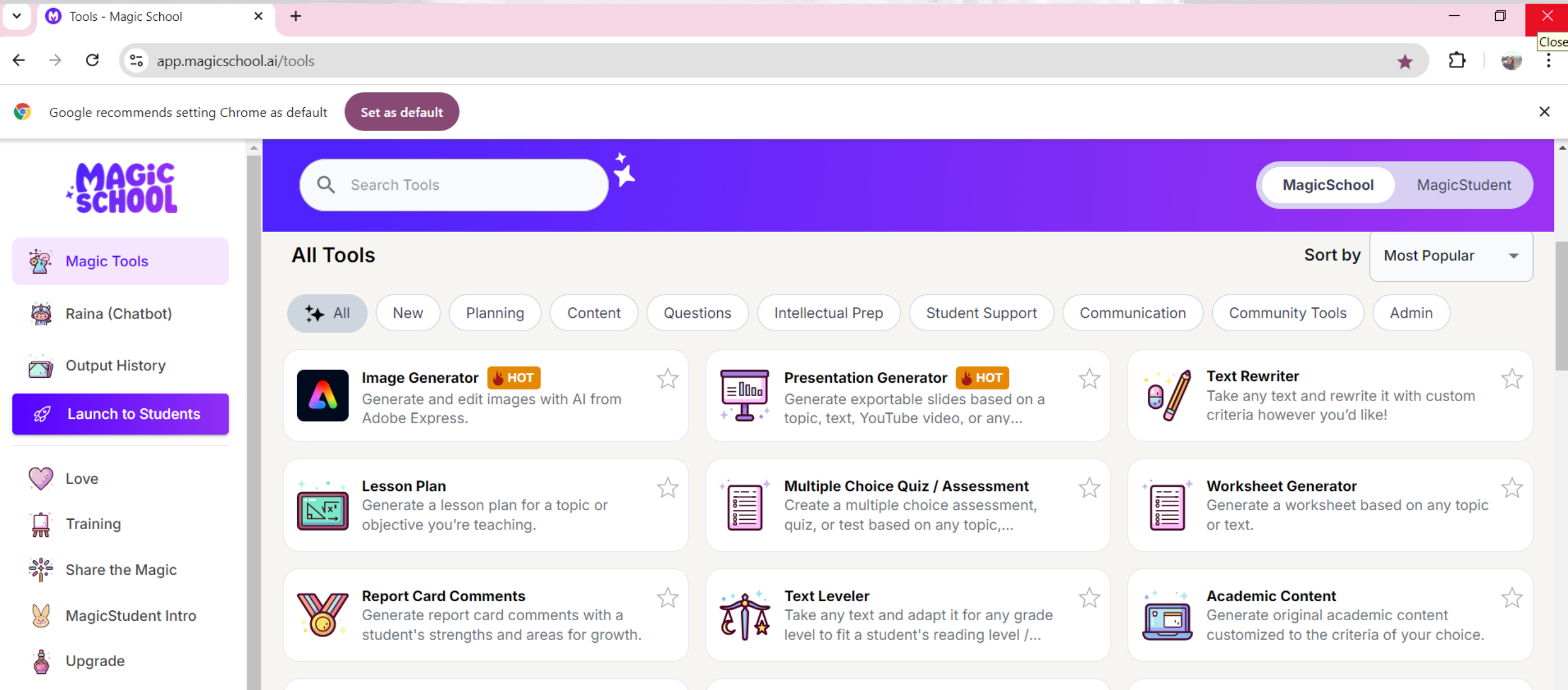
1. **Using AI:** Magicschool.ai, asking for relevant questions.
2. **BOT-integration:** Using questions from Magicschool.ai, compiling questions in a BOT. (BOT used - Landbot)
3. **3D Printing:** Finding and printing manipulatives. (3D printer used – CREALITY K1C, Hyper filament used)

AI, BOT and 3D-printing driven Lecture Integration

Practical implications:

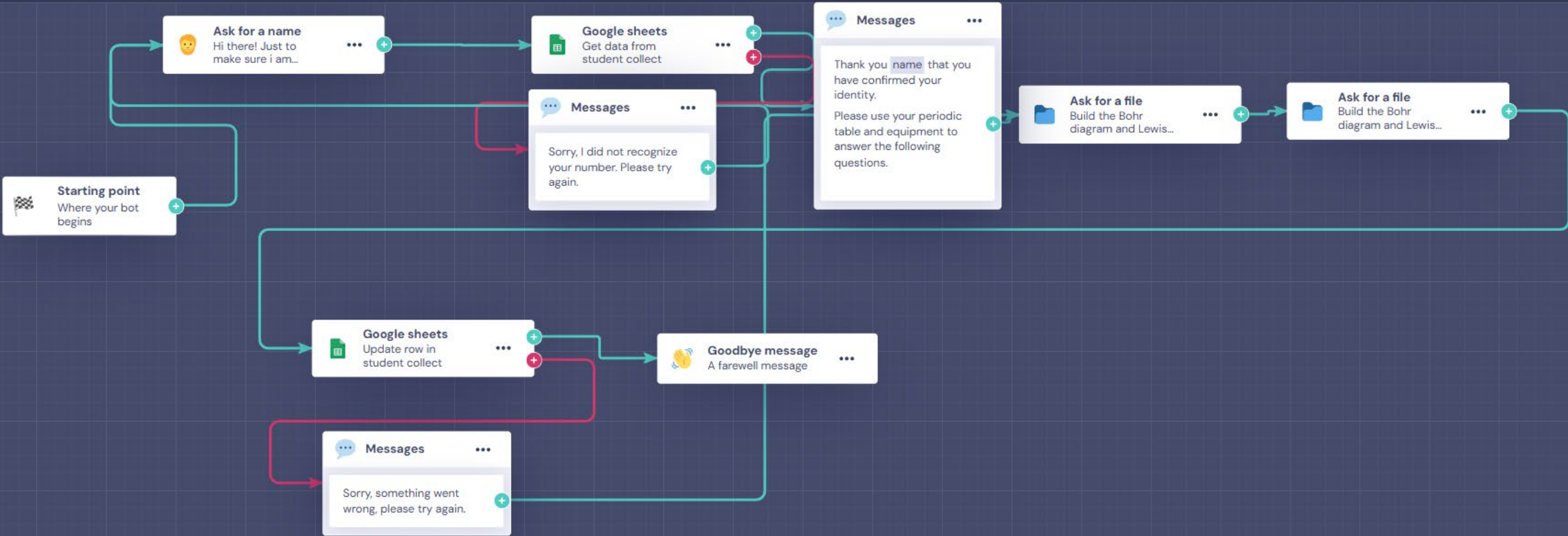
- **Personalised learning** – adapt lessons to different learning styles
- **Interactive learning tools** – bots can serve as virtual assistants, guiding learning
- **Enhanced creativity and innovation** – as educator, what you think can become a reality
- **Improved accessibility** – expose students to manipulatives that are not on shelves
- **Record information** – student's responses recorded

How did it look?



AI, BOT and 3D-printing driven Lecture Integration

How did it look?



Anting driven Lecture Integration

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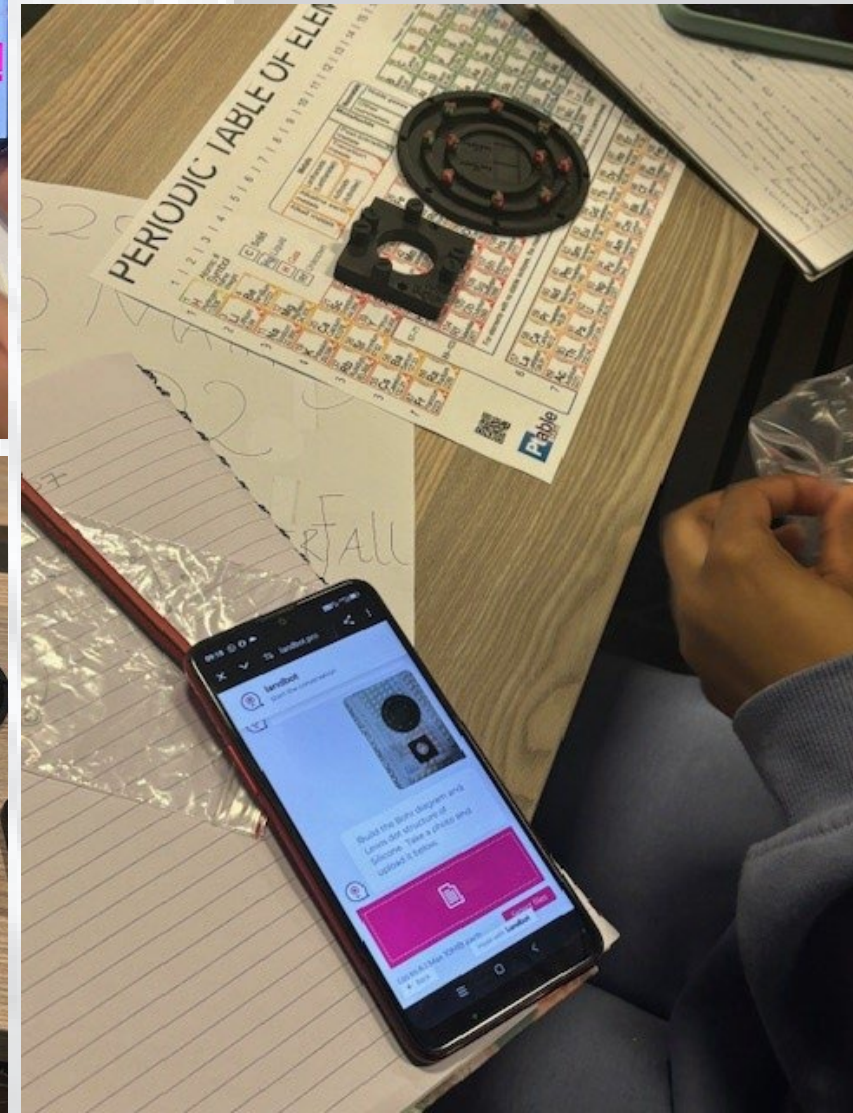
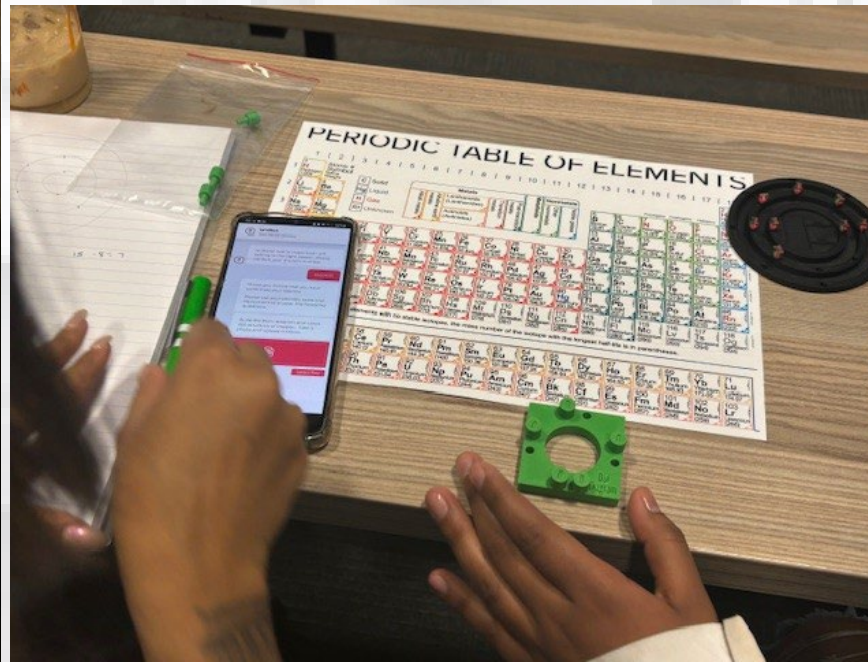
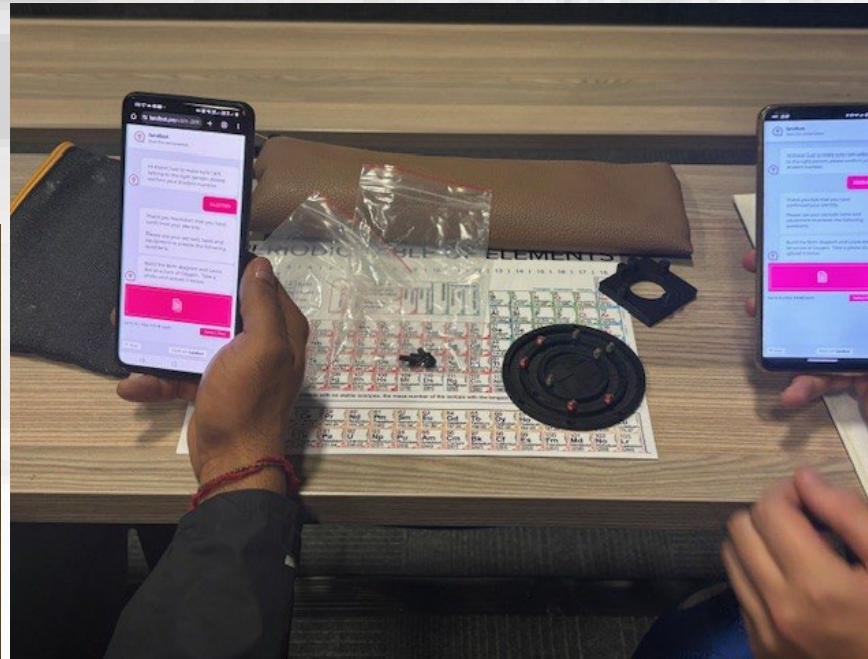
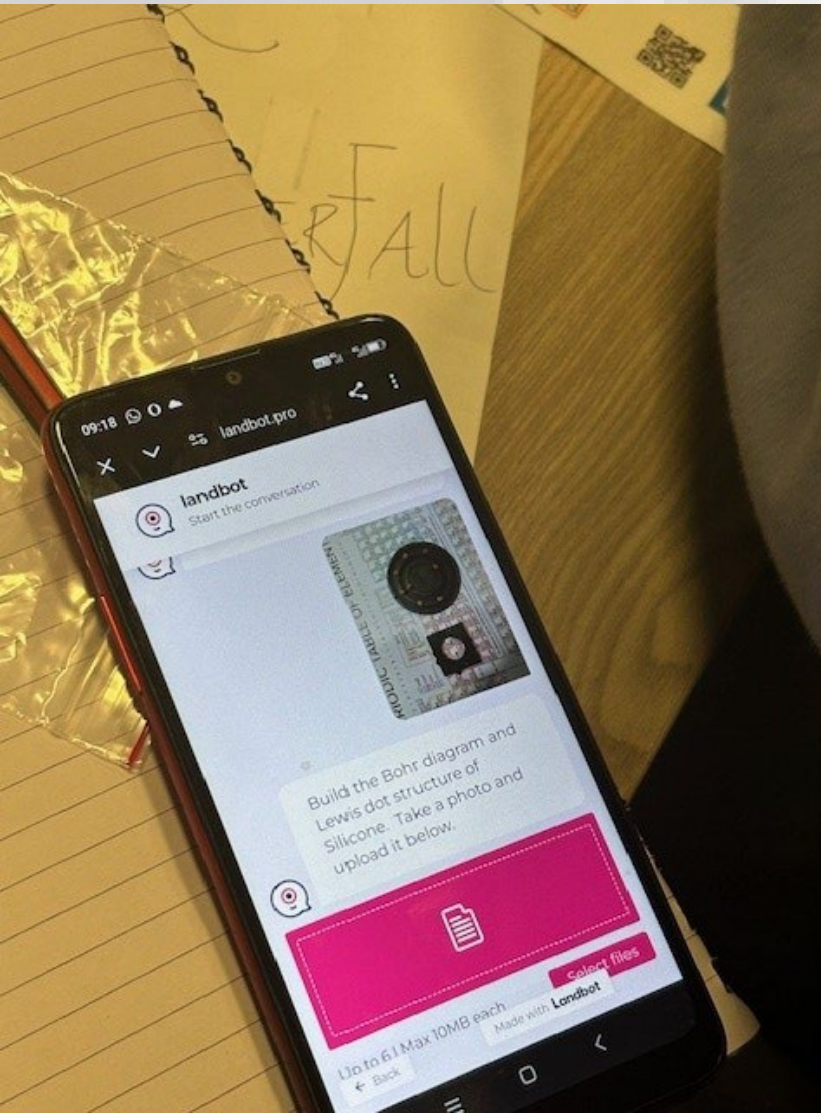
AI, BOT and 3D-printing driven Lecture Integration - Science



| | | |
|-------------------------|-----------------------------|---|
| Creality K1C 3D printer | 600 mm/s | Acceleration of 20 000mm/s ² |
| Bohr diagram (circles) | 4 = 104min; 19,2m (4,8m) | Cost of 1 = R4,80 |
| Electrons | 200 = 147min; 12,8m (0,06m) | Cost of 1 = R0,06 |
| Lewis-dot | 6 = 142min; 20,1m (3,35m) | Cost of 1 = R3,35 |

AI, BOT and 3D-printing driven Lecture Integration

How did it look?



Future Opportunities, Considerations and Challenges

Opportunities

Enhanced learning with 3D printing

STADIO Community engagement outreach – providing manipulatives

Selling of 3D printed manipulatives

Building up student teacher toolkit (more interactive/explorative lessons)

Considerations

Integration into the world of work (expose to new technology)

Future teachers having manipulatives for their classrooms – some schools do not have BOTS for guided learning

Challenges

Cost (3D printers, BOT subscription)

Outdated software

Maintenance

Skill

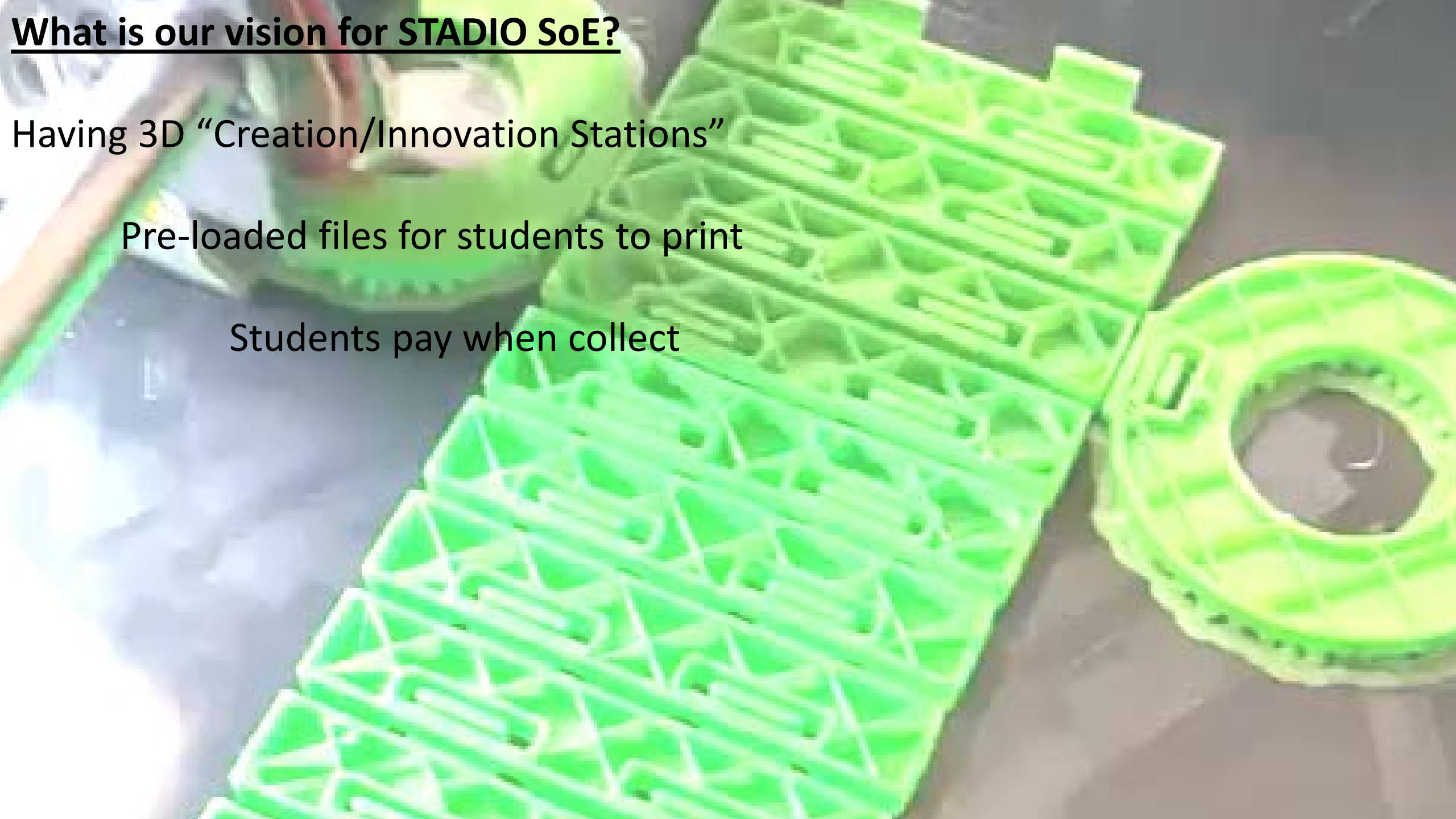
Accessibility

What is our vision for STADIO SoE?

Having 3D “Creation/Innovation Stations”

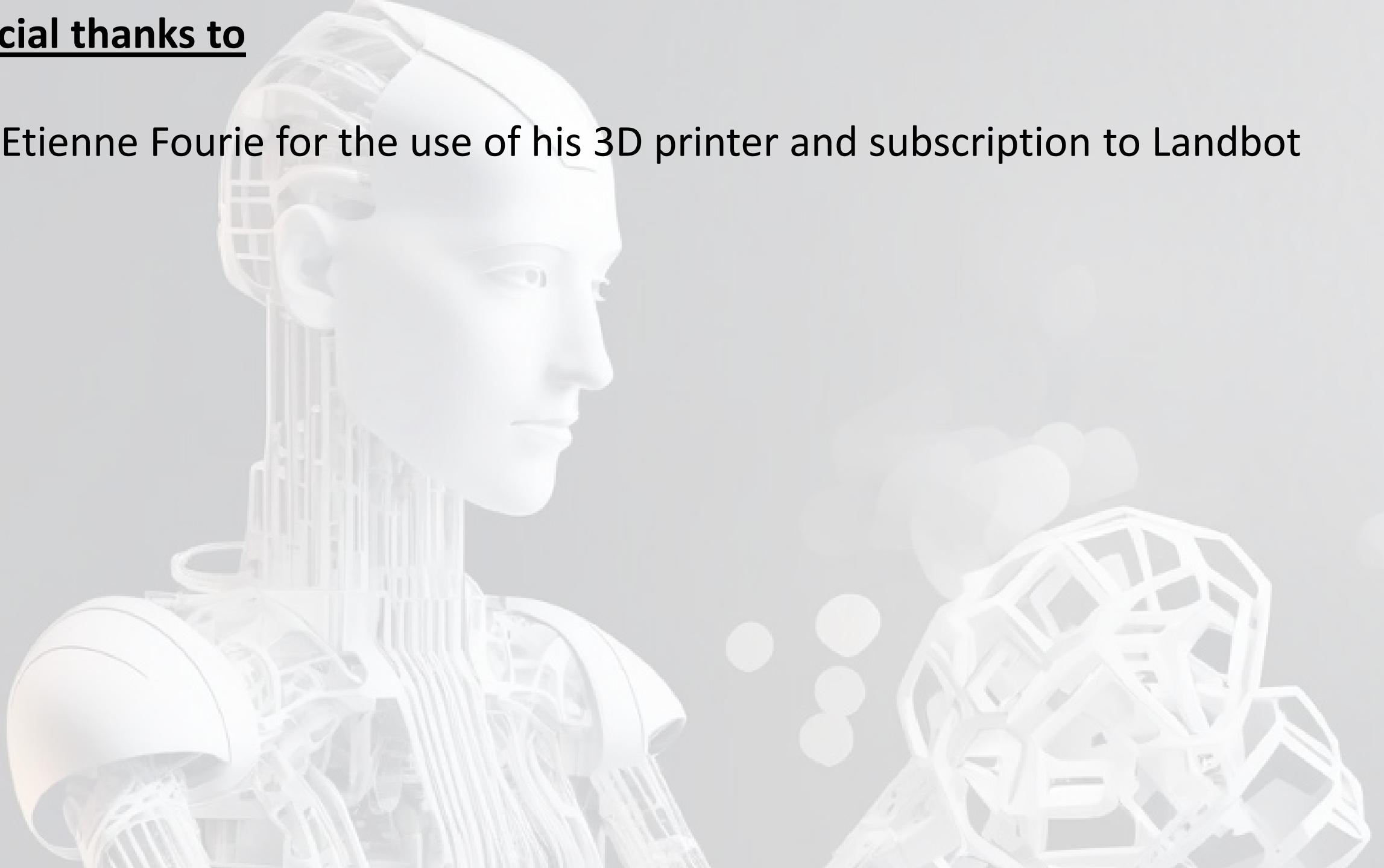
Pre-loaded files for students to print

Students pay when collect



Special thanks to

Mr. Etienne Fourie for the use of his 3D printer and subscription to Landbot



References

AbouHashem, Y., Dayal, M., Savanah, S., and Strkalj, G. 2015. The application of 3D printing in anatomy education. *Medical Education Online*, 20:1,2987. DOI: 10.3402/meo.v20.29847.

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