Lightboard – a new teaching tool at the Faculty of Science and Technology at UiT

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ABSTRACT: We would like to present a new tool that was built by three lecturers at UiT last semester – Lightboard. This tool was used before in other countries and other universities, but never at UiT. The COVID-19 pandemic situation motivated the lecturers to find a way to do online lectures differently. Blackboard and chalk work well for natural sciences as long as the lecture is physical and the teacher has an eye contact with the students, but this was not an option since all lectures were turned to online. The solution was found. The Lightboard gives an opportunity to face towards the students while recording the lectures and they can follow the lecturer's hands while writing.

1 INTRODUCTION

During the COVID-19 pandemic there has been a need for the academic community at the Faculty of Science and Technology to find alternative ways of conducting teaching. In order to have good discussions with students in STEM subjects, one is completely dependent on being able to draw, visualize, explain, point and gesture and be able to write formulas and expressions. Given the uniqueness of the science subjects, many lecturers therefore prefer to use ordinary blackboards. Manually drawing also keeps the pace of the presentation such that the students can follow the chain of reasoning.

In the autumn 2020, a group of three lecturers: Björn Gustavsson, Juha Vierinen and Torbjørn Tveito at the Department of Physics and Technology took an initiative to build a Lightboard. All three were constrained by the restrictions connected to pandemic situation to give their lectures in physics online. The way the lectures are presented is up to lecturer, however, many think that recording of the blackboard lecturers is not so interactive. The lecturers developed and tested a prototype of a Lightboard to make their own videos and to stream teaching better.

2 A FIRST PROTOTYPE

The idea of giving a lecture by using a Lightboard is not new and was applied before at other universities. The inspiration to make one in Tromsø came from science presentations on YouTube.

The frame for the board was repurposed from an unused whiteboard. An acrylic plate was installed into the frame. In addition, LED light strips were installed around the acrylic plate in order to specifically illuminate the writing. A dark curtain was hanged behind the Lightboard giving a high contrast, dark background. The frame has small wheels so that the board can be moved. Special neon chalk markers were bought, as the chalk scatters light efficiently. A single-lens reflex camera with manually adjustable exposure was installed in front of the Lightboard. Next to the Lightboard a microphone was mounted, and a spotlight highlighting the lecturer was mounted above the frame.

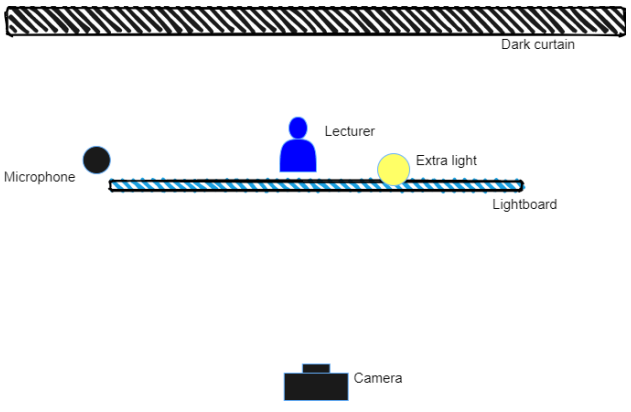

Fig. 1. A scheme of the first prototype of a Lightboard studio, https://app.diagrams.net/

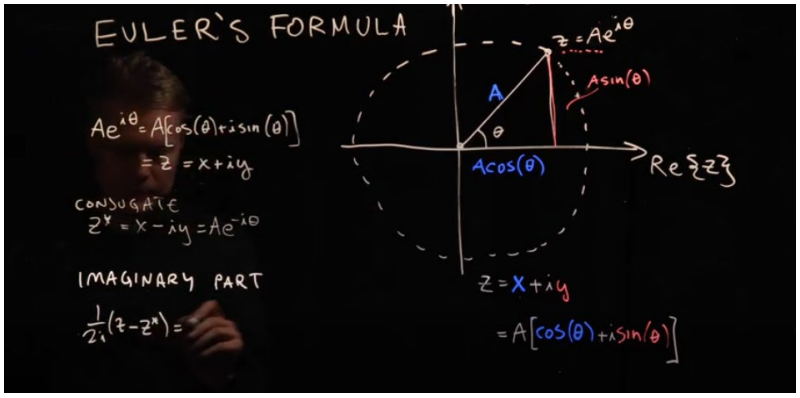

Fig. 2. Screenshot of the lecture of Juha Vierinen by using the prototype of the Lightboard, https://www.youtube.com/watch?v=EAbFAWgQFrE

The first prototype of the Lightboard was built rapidly, it took only two weeks and the total material cost was about 15 000 NOK. However, the first prototype had some technical challenges and disadvantages. It soon became clear that this was not a lasting solution: the acrylic plate quickly became scratched, the light strips around the plate could not be installed exactly around the edge of the plate and therefore some of the colors of the neon markers were not visible. The board itself was also quite small, did not stand firmly enough on the floor and moved during the lectures, and thus sometimes parts of the board ended up outside of the camera field-of-view. In addition, the videos had to be mirrored afterwards with digital tools and this caused complications in online lectures. The geometric effect of the mirroring combined with the audience point of view being on the other side of the writing surface has to be taken into account when presenting for example three-dimensional vector spaces. Due to technical issues, some videos had to be re-recorded several times. Moreover, this impromptu studio was built in a laboratory space not intended for lectures.

3 REFLECTION OVER THE USE OF THE LIGHTBOARD

The experience has been very positive despite the technical issues. The Lightboard allows the lecturer to write and draw while maintaining direct contact with the students and lecturer can thus present the material in a more natural, interactive, and engaging way.

The Lightboard partially solved one of the biggest challenges with filming a lecture on a usual blackboard, when the lecturer mostly turns towards the blackboard and students do not see what is written. While using the Lightboard, the lecturer maintains closer contact with the students by being able to speak and explain with visual aids, at the same time gesturing or pointing out parts of the board with their hands and by using body language. Peshkin [1] declares that by using a Lightboard, the lecturer can "talk with his hands". He also cites the studies [2,3] showing that it is natural for people to follow the hands. This gives an advantage over recording a classic blackboard lecture, where the hands and face are often hidden in front of the lecturer and students only see the result, not the process itself. With Lightboard, it is the effect of writing "in the air" that attracts attention. The neon lighting effect of chalk pens creates a strong visual connection with the viewer. The main benefit is that the lecturer faces the audience while writing on the board, so that the students can see the facial expressions or even read the lips. Learning is more effective when the lecturer looks at the audience through the board, than if they are constantly looking at the board.

The lecturers have received good feedback from their students, who like Lightboards better than the whiteboard lectures. Students generally like the recorded lectures that they can re-watch later.

The news about Lightboard have spread at the Faculty of Science and Technology and one more lecturer has used the Lightboard for recording videos in Mathematics. However, as mentioned above, the room is a laboratory and access to the Lightboard was limited.

4 FROM A PROTOTYPE TO A FULLY-FLEDGED STUDIO

In a joint initiative, Result, the IT department, the Faculty of Engineering Science and Technology, the Faculty of Science and Technology at UiT The Arctic University of Norway, and KvaNT project (Quality in Education of Science and Techology) arranged a workshop series in the autumn 2020 with

the aim of mapping and defining the need for digital tools for both teaching and assessment at UiT within the STEM subjects. In the pandemic, there has been a strong need among the academic community at the faculties to find alternative ways to run teaching – both for online lectures and for recording teaching videos. The survey revealed the need for new digital tools for lecturers of STEM subjects. In parallel in the autumn of 2020 three lecturers at the Institute for Physics and Technology built the Lightboard prototype as mentioned above. One of these lecturers was interviewed within the framework of a series of workshops and the Lightboard idea spread further. Other lecturers and the IT department were inspired by the idea and soon the employees at the KvaNT project took initiative to apply for financial support from UiT for building a Lightboard studio, which was approved.

In a pilot program, the academic community at UiT has decided to develop this new concept. The tool will contribute to more user-controlled production of teaching videos. The tool will consist of a glass board illuminated with LED lights. For the studio, a 27 m^2 room was allocated, which will be painted black. The room will be furnished with adapted lighting and a conference room audio technology of the type TeamConnect Ceiling 2. A VHD VX60 camera will be installed from the ceiling. A screen will be installed next to the camera, to which the video will be sent directly. This means that the lecturer sees what the board looks like for the viewers and can make necessary adaptions in real time, reducing the need to re-record lectures and allowing a smoother streaming experience.

Behind the Lightboard it is planned to set an electric height adjustable desk. On the desk there will be a PC with installed software for video editing and streaming, and tabletop touch screen for room control. The Lightboard will be supplemented with a document camera, where small calculations, proofs, and examples can be presented without erasing the Lightboard.

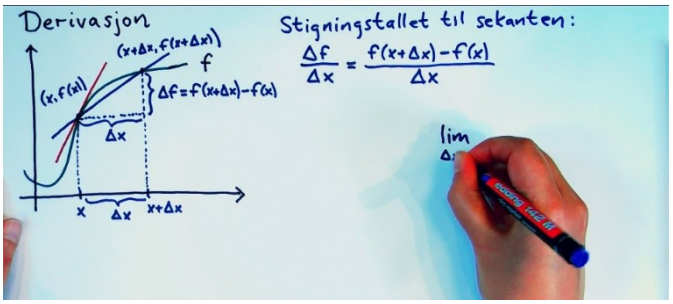

Fig. 3. Screenshot of the lecture of Klara Hveberg on MatRIC, 2017 recorded by using a document camera, https://www.matric.no/videos/181

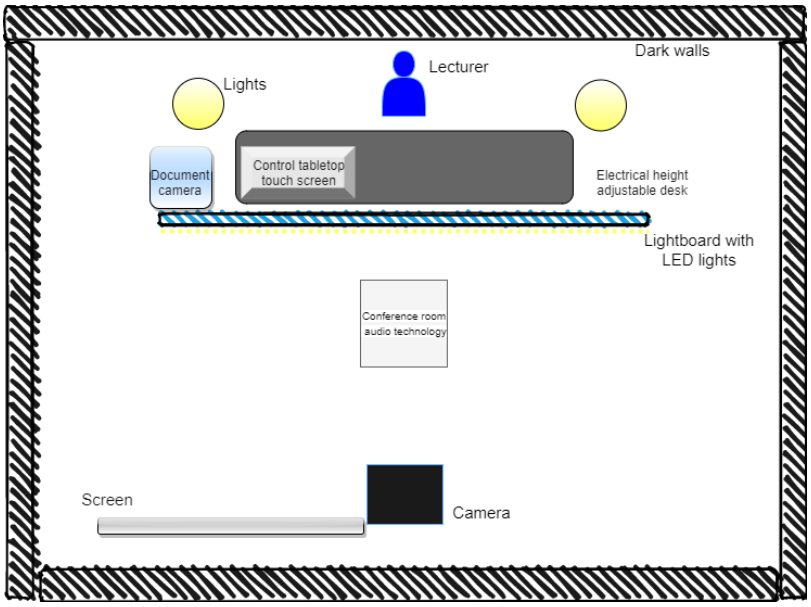

Fig. 4. A scheme of a planned Lightboard studio

The studio shall be as user-friendly as possible, reducing the need for support staff present and where the IT department contributes with technical support and operation. The lecturers should not wear bright, patterned clothes in order to blend into the background.

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