Using an ”unknown mystery” as a case for teaching students Information/Communication Technologies (ICT).

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ABSTRACT

One problem in Norway is the lack of interest in mathematics and physics among young students. Too few young students choose mathematics and physics which lead too few students with the right background for studying Information and Communication Technologies (ICT). This problem is not only for ICT, but also for engineering and natural science.

Another problem is the lack of cases which activate existing ICT, engineering and natural science students. A case which raise the attention to a top level, and keep them motivated.

The “unknown” or a “mystery” is exciting, and stimulate the thoughts of many people. Scientific TV programs about mysteries do get a high seeing score.

Many young people like to take part in something exciting. Going out in the wilderness, exploring and hunting for a mystery is exciting, if the setting is right. This can be combined with teaching instruments and informatics, mathematics and physics. The students are equipped with instruments and computers, and if they know how to operate these, they may take part in “a discovery”. This is a new setting for teaching. This has been tested both for young students and elder students in Norway with good results.

Keywords: Unknown light phenomenon, The Hessdalen Phenomenon, Science Camps, Teaching

1. BACKGROUND

Junior high school students
The number of students in ICT and engineering has decreased dramatically in Norway the last two, three years. One main reason is that too few young students have the right background in mathematics and physics to become a student.

The interest of basic mathematics and physics is very low among young students in Norway. Very few junior high school students choose mathematics and physics. This will be a problem in some years when the working people with this background are pensioned. There are not enough graduated students to take their jobs. The Norwegian government has emphasized this problem and gives support to project which can influence young student to choose math’s and physics. Science Camp is one such project.

One reason for this lack of interest for math and physics may be the lack of knowledge of how interesting and exiting a day for a researcher can be. Another reason is that students often have a boring teaching, which does not stimulate their engagement.

College students.
The students, who already are in a technical college, studying ICT and engineering topics, need engagement. The more engaged a student becomes, the more he/she learns. A student with lack of interest in the topic does learn very little. A lecturer needs to find good cases which can engage his students. A case which put the student in the researcher’s role, where he may come up with some results other people are interested in.

“The unknown” or “a mystery” engage people. It is exiting. Several books, articles, TV documentaries, movies have been made about “a mystery” of different kind. The popular movies Indiana Jones combine the mystery with actions.

Why not combine a research of a mystery with teaching? This should be a success if the setting is correct. This has been done in two different ways on Norway. One was called Science Camp, which has been tested both for junior high school students and college students. The other was as college student projects in developing an automatic measurement station.

2. THE MYSTERY

The mystery used is an unknown light phenomena showing up in the small valley Hessdalen in Norway. The

valley is located 35 km north of the town Roros and 120 km south of Trondheim city. Hessdalen is about 15 km long and less than 150 people lives there. This valley is 530km north of Østfold College.

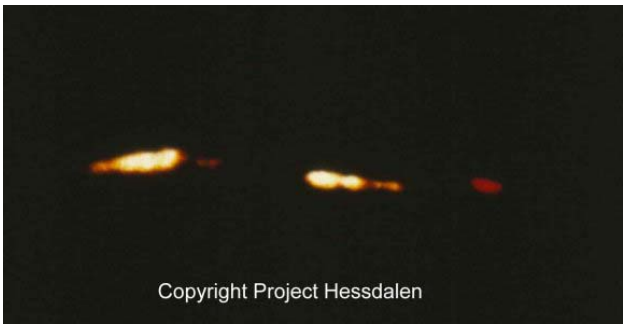

Fig 2.1 - The light phenomenon. Three lights together

The inhabitants started to see a strange light moving around in the valley late November 1981. The light could be seen nearly every day. The number of sightings increased to a maximum of 20 observations a week in January 1982. The sightings decreased towards the summertime, but it increased slowly during the autumn to the same intensity again the next winter.

The reason for why there were more observations in the wintertime may be due to the fact that it is easier to see the light when it is dark outside. Hessdalen valley is close to 63˚ latitude, so during most of the day is it dark outside in the wintertime. In the winter of 1984 did not the number of sightings increase to the same level as it was in the two previous winters. In 1985 was the phenomena nearly gone. The number of sightings is now in the order of 20 a year.

Fig 2.2 - The light phenomenon. Yellow light on the mountain

The unknown light phenomena could be so strong that it illuminated the ground beneath it. Sometimes it moved close to the houses. Some inhabitants were frightened. One man said he was woken up in the middle of the night due to too much light in his room. He went up from his bed and saw the light was coming from outside. A big light was passing by, outside his window.

The size of this yellow light is estimated to be from 20m down to 3m in diameter. It can move slowly around down in the valley for up to two hours. Sometimes it stops and stands still for several minutes before it starts moving again. The color is mainly yellow, but sometimes there is a red spot on top of it.

The light phenomenon is also seen as short white or blue flashes. The flashes can last from some few seconds down to a fraction of a second. This type of light is so different from the yellow one so it might be from another origin. The third type of light looks like several light together, which seems to be connected to something which the observer describe as a black object.

No research institutes took any initiative to start any research on this phenomenon. Then some friends got together and started their own research project.

3. PROJECT HESSDALEN

In the summer of 1983, one and a half year after the first sightings, Project Hessdalen started. The main goal was to get more scientific data about the phenomenon in Hessdalen. Preparations were done during the autumn and a field expedition was carried out from 21 of January to 26 of February 1984. 40 volunteers participated out in the field.

Different types of instruments were installed at the Headquarter, which was a trailer located on a hill in Hessdalen. Most of the participants were at the Headquarter, watching the instruments or looking for the lights. Two other groups, equipped with cameras, were located on two of the nearby mountains. Radio was used for communicating with the Headquarter.

Total 53 visual sightings were recorded during the fieldwork. The phenomenon was also recorded on to radar, spectrum analyzer and magnetograph and on different cameras. All the details can be found in the technical report:
http:// www.hessdalen.org/reports/hpreport84.shtml

A new fieldwork was prepared and run in February 1985 with a similar amount of participants. Only one visual observation was done during the period of 4 weeks. It seemed as if the phenomenon was gone.

It was not completely gone. In 1993, the inhabitant told that there were still observations, but the amount was in the order of 20 a year. This amount had probably been there all the time, but the inhabitants had stopped telling about the observations to the public. The reason for that was that the press commented their sightings in a bad manner.

The Project Hessdalen started again. Now it was located at Østfold College (http://www.hiof.no). That was due to one of the leaders from the first Project Hessdalen (Erling Strand) now was lecturing at that college. The other members of the old Project Hessdalen team had not the opportunity to participate in this new Project Hessdalen.

4. THE AUTOMATIC MEASUREMENT STATION.

The new Project Hessdalen decided to develop an automatic measurement station (AMS) instead of gather a lot of people watching for the light and looking at the instruments. An automatic station could do this all the time with a minimum of cost. Instruments recordings and pictures could be recorded automatically.

The students at Østfold College got the task to develop this automatic station. The first groups of students started the work in 1994, as their final project. Student groups from both computer sciences and electrical engineering have been doing this. The first version of the AMS was ready to be installed in Hessdalen and set in operation 1998 after the work of 9 groups. Later more groups have been working with the expansion of the station. Total 17 Norwegian student groups have worked with the development of the AMS since 1994.

Fig 4.1 - The trailer for the AMS

The AMS was build into a small trailer. The first version consisted of two computers connected in a local area network. One computer analyzed pictures from a black-and-white CCD cam every second and if a light suddenly showed up, the picture was sent to a web-server and a video recorder was started and run for 12 seconds. The analyzing software did not analyze those parts in the picture where there were roads or houses. The other computer read the earth magnetic field. All changes in the magnetic field was recorded and sent to a web-server. (http://www.hessdalen.org). The connection to the web server was through an ISDN connection.

The AMS has been expanded with more computers and sensors. Total 5 CCD cameras are connected to four computers. The software analyzes pictures from these cameras every second so that an unknown light can be discovered and recorded. Two of these cameras are located 171 m apart, so the distance of the unknown light can be calculated. One camera has a zoom, and is mounted on to a pan-tilt unit so a close-up picture can be taken. The other cameras have high sensitivity so the small and short duration flashes can be captured. Two different kind of three-axis magnetometer are used for recording changes in the magnetic field. There are also EM measurements and a weather station in operation. Totally 7 computers are in operation. The software on all these is developed by the students. The connection to the Internet is now by ADSL.

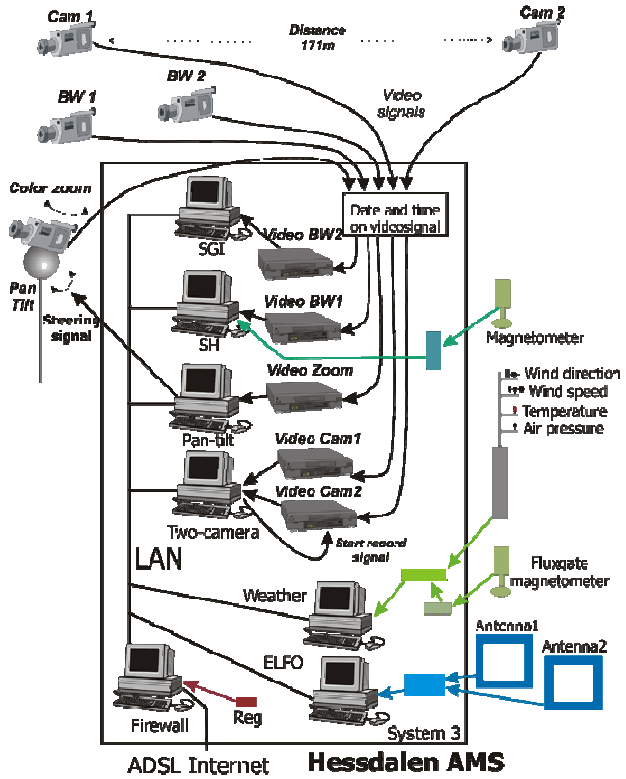

Fig 4.2 - Figure of the instrumentation

The AMS incorporate many different kinds of topics covered in a Computer Sciences study, as Artificial Intelligence, Picture Analyzing, Database, Web server, Network, Communication and interface techniques.

This station was the first of its kind in the world, and got a lot of publicity. Even the Discovery TV channel has made TV programs where they have shown some of the recordings done by this AMS. The groups of students working with this station have got publicity, which they enjoy. That inspires them to do a good work.

The developments of the EM measurements in the AMS have been done in cooperation with Institute for Radio Astronomy (IRA) (http://www.ira.cnr.it/) in Italy. Students from University of Bologna have developed part of the instrumentation for EM measurements. The Italian students have been doing this at IRA, and they have traveled to Hessdalen and installed the equipment in AMS. Norwegian student groups have been developing EM measurements system at IRA in Italy. This cooperation has been very positive for the students, and they enjoyed going abroad.

This way of using the mystery in Hessdalen as a case for the students has been successful. The student groups have been discussing "what" and "how" to measure for finding out of this unknown phenomenon. They have build the automatic station and written all the software. Their works have been written about in scientific journals.

Another way of using the mystery in Hessdalen in teaching the students ICT is to run Science Camps.

5. Science Camps.

Science Camp is another way of teaching the students. Instead of using the classroom or the lab, Science Camp takes the students on to an expedition and teaches them out in the wilderness.

The expedition is a little bit like an Indiana Jones adventure. The students are hunting for an unknown mysterious phenomenon out in the wilderness, with computers and instruments. They get the feeling they take part in a discovery.

Science Camp has been tested with different kind of students. 15 year old students from three different junior high schools, and 20 to 30 year old students from Østfold College.

Science Camps for young students.
For the 15 year old students the setting is this: The students are first told about this phenomenon in their classroom. The presentation is done by emphasizing the mystery and that it is still unsolved. We show pictures of the phenomenon and tell strange stories. We finish the presentation by asking; "Do you want to take part in an expedition". The young students are so engaged at this point that they say YES. We say then that to be able to get some data you need to have some knowledge about the instrumentation and how to use them. Few days later we invite these young students to the college for teaching them the instruments, computers and some of the physics behind. The young students are very keen on learning, and they learn fast. They even manage some theory which belongs to elder students.

To run the Science Camp for up to 50 students in the field we have help from a group of from 6 to 12 students from the college, 4 to 5 of the young student's teachers, 2 to 3 leaders from Østfold College and some volunteers.

The engagement of the young students is still high when the time for the expedition has come. It starts with a long travel (530km) to the mysterious Hessdalen valley in Norway.

Fig 5.1 - Young students setting up the instruments

The tents and the instruments have already been carried up on the two mountains, one on each side of the valley. Altitude is between 800 and 900 m above see level. There are three stations totally. The Headquarter is located down in the valley in an old abandoned schoolhouse. Altitude is 600 m above sea level. This station communicates by radio with the stations on the two

mountains and do record all sightings and instrumentation readings.

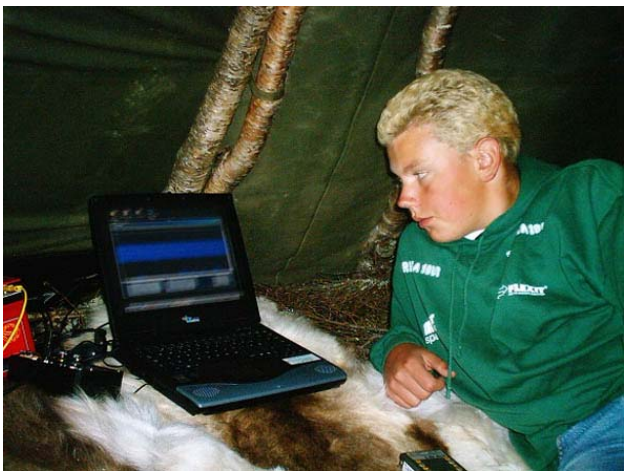

Fig 5.2 - PC recording EM-signals

The young students are divided into three groups. One group will be at the Headquarter and the two others are at the stations on the mountains. The three groups change location every day, so all participants have been on all stations during three nights.

Every young student in the group has their own specific task. They have all been specialized in running different kind of instruments. One uses the lap-top computer for displaying and recording all the low-frequency EM signals. One operates the spectrum analyzer, capturing any high frequency EM signals. One reports the data from the weather station to the Headquarter every hour. Another read the background radiation and report that to the Headquarter. Some have been trained in using cameras. All have been told to look for the light.

Fig 5.3 – One group at mount Finnsa

There are people present at the stations which do have knowledge about the instrumentation, so the young people may get help if they need to.

During the daytime the preparation for this nights work is done. The students trained in chemistry take samples of the ground. The young pupils is reminded about what they shall do up on the mountain. They pack food, clothes and a sleeping bag. They are going to stay out on the mountain until tomorrow. They will look for the lights as far out in the nighttime they manage, which typical is between midnight and 02:00 in the morning. Then they go to sleep in a tent. The temperature can go down below freezing, but the tents have the possibility for heating. It is possible to make fire in the middle of the tent, but then someone needs to stay up watching the fire. Normally they all go to sleep.

The walking time from the parking slot up to the station on mount Rogne is 45 minutes and 20 minutes on mount Finnsa. We start driving towards the mountains at 17:00. Then it will be time enough to walk up and do the necessary preparations before it is dark. The expedition is done in September, when it becomes dark at 18:50. Everybody is ready before that and the hunting for the unknown light starts.

Luckily the lights show up some nights, and the students are engaged. They do get the data and they report back to the Headquarter. They are in action until they become tired. They go to sleep in the tents, and are wakening up at 7:00. The sun is up and they walk down the mountain. Someone get them at the parking slot and take them back to the central house, where they get breakfast. Then some go to bed for some more hours. Normally they don't get enough sleep up on the mountains.

Three nights of work is enough for most of the students. Some do like to go on and don't like to go back to their ordinary teaching. Some months later all of the students wanted to go back and do it once more.

The young students used Monday for traveling. They arrived in the valley on Monday evening. Tuesday morning was used for preparation and the first night out was Tuesday to Wednesday. The last night out was Thursday to Friday. Friday was used for traveling back home.

Science Camps for college students.

Because of the success in running Science Camp for junior high school students we wanted to do the same for our own college students. It has been done for the first year students at the department for Technology, Innovation and Entrepreneurship. The Science Camp was part of their Physics course.

The running of Science Camp was much the same as for the young students. The main difference was that the teaching of the theory and instrumentation was done in Hessdalen during the Science Camp, instead of some weeks before as we did with the young students. The

main reason for that was that the college students start their study later in the autumn than the young students, so there were difficult to find time for such teaching before the expedition. The feedback from the students says that the teaching of using the instruments, and the theory behind should have been done before the expedition.

Fig 5.4 – Controlling the data

6. CONCLUSION.

The first Science Camp for young students was run September 2002. One week with 41 students and 5 teachers from a junior high school located in a town. Let us call them team A. Team B was 34 students and 4 teachers from a junior high school located in the countryside. The next Science Camp for young students was run one week in September 2004. Team C was 40 students and 4 teachers from a junior high school located in a town.

The first Science Camp for college students was run one week in September 2003. Let us call them team College1. The next Science Camp for college student was run one week in September 2004. That is team College2. They had their Science Camp three weeks before team C.

In team A the relationship between the students and their teachers were free. It seemed as if the students did not have so much respect for their teachers. That made us in the leading team a little bit worried, and we did prepare to set our self in respect. That was not needed. This teamed worked very well. Much better than what was expected in forehand. The young student was very keen on this expedition, and all their actions were focused on their job. Even students which were known for being "a problem student" acted perfectly. There were some kinds of work which they did manage to do good, so they did not make any problems. All students were keen on doing a good job.

In team B one teacher had full control of all the students. This teacher was physical and psychological big, and had very high respect by the students. If this teacher said something, all students listen to that. We believed in forehand that this would be a group with no problem. Well, there were no problem, but the students had not that high spirit in their job. They mainly did what this teacher said they should do. It was not so much **their case** as it was in team A. Team B did do a good job, but their spirit for the case was not that high as in team A. But it was high enough.

The spirit for the job was also high in team C., but not so high as in team A. One reason for that could be the short of time before the expedition and the preparation in forehand. The start of the preparation was done after the students started on school in August. They need probably some time for preparation. In team A and B the first presentations for the students was done in March.

The college teams where not so easy to engage. They were older and took this as a job. They said it was a good way of learning the other students to know. Some said it was exiting and they enjoyed it, but the high spirit is easier to get in junior high school students.

Overall it was a success. The students do remember their expedition, and they enjoyed it very much, even if it was tough.

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