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2. Organisation und Betreuung

Fig.: 2 The staff working at research institute

My Project at the Research Institute for Textile Chemistry and Textile Physics was managed by Univ.-Prof. Dr. Tung Pham and Dr. Michael Cordin. Dr. Michael Cordin supervised me throughout the three weeks and explained everything to me for each step of my project. For example, he taught me how to work with the testing machines and to chart certain data. If I did not understand everything right away, he would explain it again. Whenever I started a new process, Dr. Michael Cordin showed me how to do it first, until I could easily do it on my own. Univ.-Prof. Dr. Tung Pham especially helped me in the beginning. He explained, why the project I was working on was important and he introduced me to every scientist. But I could also turn to him whenever questions came up.

The Research Institute for Textile Chemistry and Textile Physics is a scientific institute of the Leopold-Franzens-University Innsbruck but is located in Dornbirn approximately 180 km away from Innsbruck.

The institute was founded in 1982 by the Federal Ministry of Science and Research, the Federal Ministry of Education and Art, the Provincial government of Vorarlberg, the Association for the Support of the Research and Development in the Textile Industry – Vorarlberg, and o. Univ. Prof. Dr. Ortwin Bobleter. He was the first head of the institute until 1998, when Univ. Prof. Dr. Thomas Bechtold took over that responsibility. In 2016, Univ.-Prof. Dr. Tung Pham was additionally appointed to a BMVIT endowed chair.

Fig.: 3 Second location of the institute

Since then the institute has been relocated and it can now be found in Höchsterstraße 73 (Fig.:4) and Rundfunkplatz 4 (Fig.:3). Those two building are about 500 m apart, so the other building can easily be reached by foot. The space is roughly 1500m^2 and many instruments and machines are available to the 25 scientists for their research and experiments.

Fig.: 4 First location oft he institute

The institute is active in research areas in textile chemistry and technology, technical textiles, textile composites and polymer materials. I engaged in the research field “Textile and fibre reinforced composites “.

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The one week of STEM summer school in Innsbruck was organised by Bianca Huber. She coordinated the stay at the "Tiroler Bildungszentrum Grillhof" (Fig.:7) as well as all of the seminars. After separation of the 57 participants (Fig.: 5) into two groups, I was assigned to group A, which was led by Bianca Huber. I could come to her with every question.

Fig.: 5 Participants of the "Sommertechnikum MINT"

The Leopold-Franzens-University was founded 1669 by Emperor Leopold I, but it was reduced to a lyceum in 1782. Finally, in 1826 the university was re-established by Emperor Franz I.

Fig.: 6 Main Building University Innsbruck

Of the 27,769 students, which were studying in the winter semester of 2017/18 at University of Innsbruck, 52.7% were women. Even though there is a higher percentage of female students overall, in science there are mostly male students. For example, technical sciences, mathematics, physics, computer science and metrology have the lowest percentage of female students. In contrast, the percentage of women in the University of Innsbruck is the highest in educational sciences, philological and cultural science and teaching.


Fig.: 7 „Tiroler Bildungszentrum Grillhof"

This is why the university offered a STEM summer school for female students in order to foster their interest in technical and scientific subjects.

3. Projekt und Tätigkeiten im Praktikum

My internship specified that I had to work 120 hours in the three weeks at the institute and my regular hours were 8 hours per day. But it was not timed when I had to work and at the institute it was common practice for every employee to define their starting and end time by themselves. Normally I arrived at the institute around 7:45 and on average days I left around 16:25. I had a 30 minute lunch break around noon which I mostly spend at a bakery nearby with Dr. Michael Cordin discussing the project and the education and life of a scientist.

During my intership I attended two lectures held by scientists from the institute called "How to make a garment with available thermal insulation" and "A Dynamic Mechanical Thermal T-peel Test Approach to Characterize Interfacial Behaviour of Polymeric Textile Composites". It was explained to me that almost every Tuesday a scientist from the institute presents his or her work in a lecture. Even though sometimes it was hard for me to

follow, through those lectures I got to know other research areas and different projects, which was very interesting. After the lectures, other scientist could ask question or offer advice and suggestions. Those discussion on the certain lectures were followed by general discussions about safety issues or organisational matters.

I also got to see the commissioning of a new embroidery machine. It was explained very thoroughly how to use the machine in order not damage it. It was daunting to be told how easily the expensive embroidery machine could be ruined.

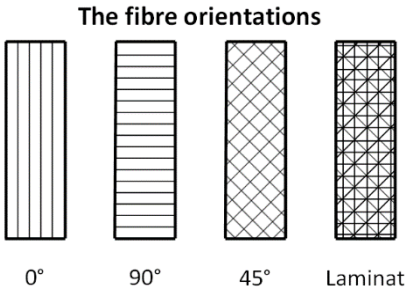

Fig.: 8 The tested fibre orientations

Aside from the seminars and the introduction, whenever I was at the institute I worked on my own small project called "All-Polymer-Composites". It was about making different composites and afterwards testing their elongation and tensile strength. Part of my task was to write a report about the scientific prospects of my work, which I gave to Univ.-Prof. Dr. Tung Pham after my internship ended.

Overall, I produced twelve different types of composites for testing. They were composed of three different types of yarns with four different fibre orientations (Fig.:8).

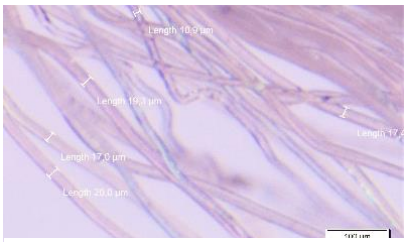
Fig.: 9 Yarn fibres on a microscopic level

All three yarns were made of Polyamide 6 and Polyamide 6.6, but they differed in the composition. One yarn was made of 60% Polyamide 6 and 40% Polyamide 6.6, the second one consisted of 70% Polyamide 6 and 30% Polyamide 6.6, and the last one of 80% Polyamide 6 and 20% Polyamide 6.6 (Fig.:9).

The difference between the two fibres is their melting point. While Polyamide 6 already melts at 225°C, Polyamide 6.6 needs a temperature of at least 260°C to melt.


Fig.: 10 The used bench press

Because of the difference in melting point, later in the crafting process, when the yarn was pressed at 230°C (Fig.:10), only Polyamide 6 melted and created a matrix around the Polyamide 6.6 fibres which are then called the reinforced phase. This is an important characteristic of a composite, which is defined as a "Structural material that consists of two or more combined constituents that are combined at a macroscopic level and are not soluble in each other."(Kaw 2006: 2). The matrix gives stability to the composite, whereas the reinforced phase gives strength to the structure. In this context, the fibre orientation is the heading of the reinforced phase. (Fig.:8)

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To produce a composite, at first, I wound a lot of yarn around a Teflon plate. It was important that the yarn was parallel and even.

When there was enough yarn on the plate, I weighed it to ensure that the amount of yarn on each plate was approximately equal. Thus, if it was too much or not enough I could still correct it. (Fig.:11)

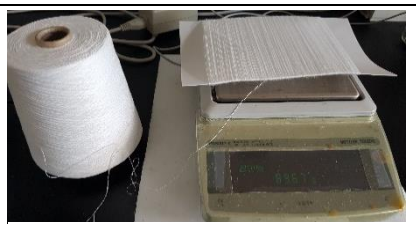

Fig.: 13 Weighing the yarn on a teflon plate

After that I had to press the plate with the yarn in the press between other Teflon and metal plates for five minutes at 15 bar and 230°C. Afterwards, I let it cool and then I could take it off the Teflon plate by cutting one edge.

I produced in total 24 yarn plates. When they were finished, I separated front and back. Next, I cut from each side a square measuring 15x15cm.

Fig.: 11 Four pressed squares in the form

To make the final composites I had to put four squares into a form and press them again at 230°C and 15 bar, but this time for 10 minutes. It was important to put the squares correctly in the forms (Fig.:12). Because of the fibre orientation, some had to be parallel and some right-angled. After that step I had my twelve composites and had to cut them into rectangles measuring 1x8cm in order to test them (Fig.:13). In this step it was also very important to cut them correctly to ensure that the fibre orientation was right.

Fig.: 12 Composite strips

From each composite I tested 10 strips regarding the tensile strain and strength until the material tore. However, three composites were so weak that the machine (Fig.:14) could not measure the tensile force. To test those, I had to first change the preload force with my supervisor so that the materials did not tear before the computer program even started measuring. Once all these default settings had been adjusted I could start measuring the elongation and tensile strength of all of the samples.

Fig.: 14 The used testing maschine

I had a clear sequence of steps to measure and record the data for each composite strip. First, I had to set up and name a new test file. Then I had to ascertain the average thickness of each composite strip. Next, I had to input this value into the computer program. After that I could carefully put the little rectangle into the machine. On the computer program I first had to zero the force and then start the test. As soon as the sample tore, the program would stop the machine automatically

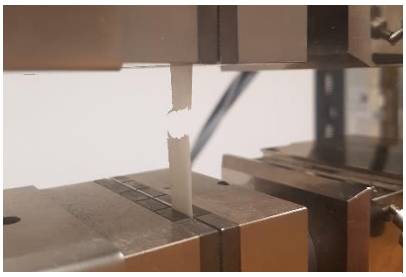

Fig.: 15 A tested strip in the machine

and I had to remove the torn strip (Fig.:15) from the machine. In order to work scientifically, I had to label both sides of every strip. At last, I had to make the machine go back to its starting point.

I evaluated the data statistically by calculating the arithmetical mean of the 10 strips from each composite. Most of the results were as expected. Some were surprising, especially the elongation of the composites with the 90° fibre orientation. These were the ones that were tested without preload force because the machine was too imprecise. This change in the testing procedure is probably the reason for the unexpected results.

Generally, it can be said that strongest composites are the ones with the 0° fibre orientation. But to really tell which composite is to best, the scope of application has to be considered. In case of the composites in scope of this project, that would for example be a suitcase. And in reality, a suitcase will not experience forces from only one direction, but from many different ones. So, for example considering the suitcase, the laminate composite consisting of yarn with 60% Polyamide 6 fibres and 40% Polyamide 6.6 fibres would probably be the best solution from the tested composites. The reason for this is the 60-40 composites have proven to be the strongest composites regardless of the fibre orientation (Fig.: 16) and the laminate structure combines the benefits of all fibre orientations.

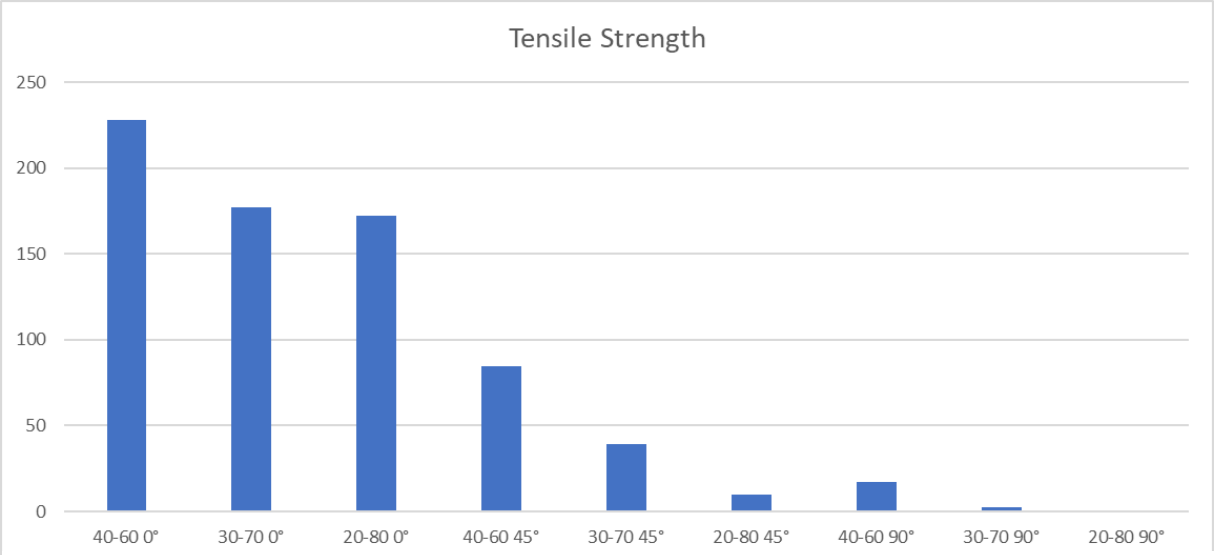

Fig.: 17 Tensile Strength of different composites

After my first week as an intern at the Research Institute for Textile Chemistry and Textile Physics in Dornbirn, I spend one week attending the “Sommertechnikum MINT”, which is a summer school with the aim to give girls a good overview about the STEM subjects and the study of each area. The courses were in areas such as mathematics, informatics, physics, chemistry, civil and environmental engineering, mechatronics, and geo- and atmospheric science. The program could be attended by any interested schoolgirl. In my case, and for about 20 others, the

Fig.: 16 Working on a physics experiment

summer school was part of the internship. Overall 57 girls attended the summer school and 21 of them stayed at the "Tiroler Bildungsinstitut Grillhof" this year. For the students, who came from outside of Innsbruck, the food and the overnight stay was for free.

I arrived in Innsbruck on Monday the 16 of July and went straight to the opening session, which was held by Bianca Huber and the vice rector for academic affairs, Univ.-Prof. Dr. Bernhard Fügenschuh. Following this was a lecture by the central student advisory services and a guided tour around the University campus. During the 60 minute lunchbreak there was a lot of time to get to know the other students. After the lunch break we were separated into two groups which stayed together for the whole week. I was in group A with all the girls, who like me stayed at the "Grillhof", as well as a few from Innsbruck. In the afternoon, my group first went to the seminar about atmospheric science, where we were told what students can do after completing their studies in this subject. For example, work in weather forecasting, research, development of technology for meteorology, and consulting insurances. Furthermore, we were told that meteorologists conduct research in the Antarctic and on mountains, in hurricanes, on climate change and many other important subjects. Interestingly, knowledge in mathematics and physics is a basis to study atmospheric science. In the end we were allowed to work on a surface map for that day, which showed meteorology data for Europe. We were supposed to find similar temperatures and draw the cold and warm fronts for that day into the map. Surprisingly, it was a lot like "colour by numbers" (Fig.: 18). For the second half of the afternoon we had a seminar and a guided tour of the "Universitäts- und Landesbibliothek Tirol".

Fig.: 19 Working on the surface map

All the other day was similar to Monday. Our morning seminars started around 8:00 and we had a 60 minutes lunchbreak shortly after noon. The afternoon seminars lasted until around 17:00.

On Tuesday group A went to the "Aluwelten" in Telfs which belongs to the company "Thöni" (Fig.: 19). In many different presentations, we learned about the history and the characteristics of aluminium, and about the company. We also got to see the big manufacturing hall. In the afternoon we made an excursion with the geology professors to the top of the Hafelekar, which has an altitude of 2300m high. Unfortunately, it was very cold and windy on Tuesday, so we could not enjoy the incredible panorama properly.

Fig.: 18 Group A visiting the "Aluwelten"

Fig.: 20 Presentation by Dr.Eugen Stark

In addition to the seminars we had a presentation after dinner on Thursday by Dr. Eugen Stark, the managing director of the „Industriellenvereinigung Tirol" (Fig.: 20). With a few examples he indicated how much companies in Tyrolia have to offer as employers. We were encouraged by him to think about working in scientific or technical jobs.

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SUMMERSCHOOL 2018

Montag, 16.07.	Dienstag, 17.07.	Mittwoch, 18.07.	Donnerstag, 19.07.	Freitag, 20.07.
Treffpunkt: 8.30Uhr Hauptgebäude	Treffpunkt: 8.00Uhr Hauptgebäude	Treffpunkt 8.15Uhr Technik	Treffpunkt: Technik 7.50 Uhr	Treffpunkt: CCB 8.50 Uhr
Kick Off Veranstaltung 9.00-9.45Uhr Innrain Gr. A+B	Firmenausflug bei Thöni Telfs Gr.A Leitner Telfs Gr.B	Mechatronik&Robotik Technik 8.30-12.00Uhr Gr.A	Bau und Umwelt Technik 8.30-12.00Uhr Gr.B	Physik 8.00-10.30Uhr Technik Gr.A / Mathematik 8.00-10.30Uhr Technik Gr.B
Zentrale Studienberatung Campustour Innrain 10.00-12.00Uhr Gr. A+B	Je 9.00-11.00Uhr			Informatik 11.00-12.30 Uhr Technik Gr.A / Physik 11.00-12.30 Uhr Technik Gr.B
Chemie 9-12Uhr CCB Gr.A	Pharmazie 9-12Uhr CCB Gr.B			
Mittagspause 12.00-13.00	Mittagspause 12.00-13.00	Mittagspause 12.00-13.00	Mittagspause 12.30-13.30	Mittagspause 12.00-13.00
Atmosphären wissenschaft 13-14.30Uhr Gruppe A 15-16.30 Uhr Gruppe B Innrain	Bibliothek - Schulung 13-14.30 B 15-16.30 A Innrain	Geologie Exkursion 13.00-17.00Uhr Häfelekar Gr. A+B	Bau und Umwelt Technik 13.00-16.30 Uhr Gr.A / Mechatronik&Robotik Technik 13.00-16.30Uhr Gr.B	Informatik 13.30-14.30Uhr Technik Gr.A / Physik 13.30-14.30 Uhr Technik Gr.B
				Mathematik Technik 14.45-17-15 Uhr Gr.A / Informatik Technik 14.45-17.15Uhr Gr.B
			Vortrag von Hr. Dr. Stark IV um 18.30 Uhr VIII	Studenten-Schüleraustausch Chemie 13.15-13.45Uhr CCB Gr.A+B / Pharmazie 14.15-17.15Uhr CCB Gr.A / Chemie 14.15-17.15Uhr CCB Gr.B / Abschluss

Fig.: 21 The summer school scheeduel

4. Meine persönlichen Eindrücke

Fig.: 22 Thinking about a math problem

I know that, in comparison to the past, people are a lot more openminded and supportive of girls working in scientific and technical jobs. But in my social environment I still experience boys being a lot more interested and encouraged in such school subjects. Most of my female friends give up before even trying to solve mathematics or physics problems. Even though I always try to help them understand, I think if they could just believe in themselves and try, they would also be able to do it on their own.

That is why I am so grateful to have been a part of this program. It tells girls that we are just as suited for scientific and technical jobs as boys are. Of course, that is by far not the only benefit. It was great to meet so many girls with the same interests and get to know them. Additionally, I also gained a lot of experience working in labs with sophisticated testing equipment and learned how precisely you must work in science.

Before my first day working in Dornbirn, I was afraid that I would not be smart enough to understand what I should be doing. However, this was unjustified, because first of all everyone working in the Research Institute was very friendly and would have helped me if I would have had a problem or a question. Secondly, everything was not only explained to me very carefully, but I also got a lot of reading material, so that I could conduct my own research.

What I liked about my placement was the fact that I was able to work on my own project and I executed every single step myself, from the yarn winding until the data charting. That was very interesting, although it has to be said that I spent a lot of time just winding yarn which would eventually get a little bit dull. But then I got to talk to other scientist about my project and some even asked me how it was to work with certain machines

because they had never used them, and it made me appreciate that I was allowed to work with machines like that. They would also talk to me about my interests and tell me about their work or what it was like to study physics or chemistry. From my internship I gained a real impression what it is like to work as a scientist. Looking back, I would say that I have learned so many new things and am glad that I got the opportunity to spend my internship at the Research Institute.

In addition to all these great experiences, I also spent one week in Innsbruck to gain an impression on what it is like to study science courses at the University of Innsbruck.

In the seminars, different professors and students tried to give us a good insight on their field by telling us about their daily life and by doing experiments with us. Because the seminars always had a clear structure and the speakers were honest, it was easy to imagine what it would be like to study the respective course. We could also always ask questions if something was not clear or if we were especially interested in a certain topic.

Although we had a full agenda with the wide range of seminars, lectures and excursions, we had time for a few extra activities. On Tuesday we had some time to explore the city and on Wednesday evening we were even able to go swimming in a nearby lake. All in all, it was a wonderful experience and I enjoined every minute of those four weeks.

Studieninfo in der Ferienzeit

Mit dem Sommertechnikum MINT bietet die Uni Innbruck Exklusivität für Mädchen.

Innsbruck – Bereits zum zweiten Mal veranstaltete die Universität Innsbruck heuer das Sommertechnikum MINT. 57 Mädchen aus Nord-, Ost- und Südtirol, Vorarlberg, Niederösterreich und Deutschland bekamen in der Sommerschule – als ersten Teil des Angebotes – die Studien und Fachbereiche Informatik, Mathematik, Physik, Chemie und Pharmazie, Bau- und Umweltingenieurwissenschaften, Mechtronik sowie Geo- und Atmospährenwissenschaften vorgestellt. Ein Großteil der Teilnehmerinnen bekam danach die Möglichkeit ein Praktikum in einem Tiroler Unternehmen zu absolvieren oder an einem universitären Institut.

Diese Praktikastellen werden von der österreichsichen Forschungsförderungsgesellschaft (FFG) finanziert. Für Mädchen von außerhalb wurde am Grillhof eine Unterbringung organisiert – die Kosten vom Förderkeis 1669 übernommen. Für die Teilnehmerinnen ist die Sommerschule, dank Sponsoren, kostenlos.

„Mit dem Sommertechnikum setzt die Universität Innsbruck eine wichtige Maßnahme, um Frauen nachhaltig für die MINT-Fächer zu begeistern", sagte Bernhard Fügenschuh, Vizerektor für Lehre und Studierende.

Die Zahl der Absolventinnen von naturwissenschaftlichen Studien sowie in den Fächern Mathematik, Informatik und Technik - den sogenannten MINT-Fächern - ist in den letzten Jahren deutlich gestiegen. Dennoch ist der Anteil weiblicher Studierender an allen MINT-Absolventen noch vergleichsweise gering.

An der Universität Innsbruck schlossen im Wintersemester 2017/18 von 73 Studierenden 37 Frauen ein Studium in Pharmazie oder Chemie ab. Von 80 Studierenden absolvierten 18 Frauen ein Studium der Geo- oder Atmosphärenwissenschaft, während 19 Frauen ein Studium in Mathematik, Informatik oder Physik als Teil der 93 Absolventen erfolgreich beenden konnten.In den Technischen Wissenschaften meisterten 83 Männer und 13 Frauen ihr Studium.

Alle Infos zum Sommertechnikum MINT gibt es auf: www.uibk.ac.at/projects/sommertechnikum-mint/ *(maba)*

Umfrage – Woher wussten Sie vom Angebot und lohnte sich die Sommerschule?

Jasmin Matti (Bach im Lechtal): „Heuer wollte ich unbedingt dabei sein, nachdem ich letztes Jahr in der TT darüber gelesen hatte. Dass es mit MINT-Studien soviele Berufsmöglichkeiten gibt, hätte ich niemals gedacht, gerade in Mathe."

Antonia Schiel (Hannover): „Beim Surfen im Internet habe ich das Angebot entdeckt. Gelohnt hat sich die weite Reise in jedem Fall. Ich hatte Mathe in der Waldorfschule nie so gerne. Der Vortrag an der Uni hat mich aber ganz neu begeistert."

Anna-Lea Blümel (Dornbirn): „Über ein Schulmail habe ich vom Sommertechnikum erfahren und Gott sei Dank auch einen Praktikumsplatz am Institut für Textil-Chemie/Physik ergattert. Auf soviele Gleichgesinnte zu treffen war cool."

Fig.: 23 appeared in the „Tiroler Tageszeitung" on the 04/08/2018

ANHANG zum REPORT

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List of references

Kaw, Autar K.: Mechanics of composite materials. Second edition. Boca Raton, Florida. 2006

List of figures

Fig.: 2 The staff working at research institute
In: N.N.: Institut für Textilchemie und Textilphysik. People.
https://www.uibk.ac.at/textilchemie/staff/ (Accessed 07.10.2018)
Fig.: 4 First location of the institute
In: N.N.: Wikipedia(Publisher): Textil HTL Dornbirn
https://commons.wikimedia.org/wiki/File:Textil_HTL_Dornbirn.JPG (Accessed 07.10.2018)
Fig.: 5 Participants of the "Sommertechnikum MINT"
In: University of Innsbruck(Publisher): Sommertechnikum MINT. Fotos.
https://www.uibk.ac.at/projects/sommertechnikum-mint/ (Accessed 07.10.2018)
Fig.: 6 Main Building University Innsbruck
In: University of Innsbruck(Publisher): Newsroom. Images
https://www.uibk.ac.at/newsroom/images/2017/hauptgebaeude_1800x1080.jpg (Accessed 07.10.2018)
Fig.: 17 Working on a physics experiment
In: University of Innsbruck(Publisher): Sommertechnikum MINT. Fotos.
https://www.uibk.ac.at/projects/sommertechnikum-mint/fotos/fotos-mint-2018.html.de(Accessed 7.10.2018)
Fig.: 18 Working on the surface map
In: University of Innsbruck(Publisher): Sommertechnikum MINT. Fotos.
https://www.uibk.ac.at/projects/sommertechnikum-mint/fotos/fotos-mint-2018.html.de (Accessed 7.10.2018)
Fig.: 19 Group A visiting the "Aluwelten"
In: University of Innsbruck(Publisher): Sommertechnikum MINT. Fotos.
https://www.uibk.ac.at/projects/sommertechnikum-mint/fotos/fotos-mint-2018.html.de (Accessed 7.10.2018)
Fig.: 20 Presentation by Dr.Eugen Stark
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Fig.: 23 appeared in the „Tiroler Tageszeitung" on the 04/08/2018
Send to me by: Bianca Huber

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