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CHAPTER 17

Development of a Community of Inquiry Based on Reflective Teaching

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17.1. Introduction

In this case study we give an overview of the development of a local Community of Inquiry (CoI) at Brno University of Technology (BUT) in Brno, the Czech Republic, during the implementation period of the PLATINUM project. The key word of this chapter is 'development' and it concerns history, goals, achievements, challenges and lessons learned of the local CoI. Other important key phrases are 'classroom observations' and 'discussion' that contributed to the professional development of the local CoI members and their teaching practice significantly.

The case study is structured in four sections. Section 17.2 briefly describes the history of the local CoI at BUT (BUT CoI). The purpose of this section is to set the background and context for the next sections, including relationships with another local CoI at Masaryk University (MU CoI) in Brno (see Chapter 13). Section 17.3 describes the formation and development of the idea of Inquiry-Based Mathematics Education (IBME) within the BUT CoI. The purpose of this section is to summarise ideas and goals of the community and its individual members as well as approaches developed, applied and adapted to achieve the defined goals in the local context of the university. Section 17.4 brings a summary of achievements of the BUT CoI during the three years of the project (September 2018 to December 2021) and a list of the most significant challenges met by the CoI within that period. The purpose of this section is also to report lessons learned and a self-reflection of the CoI members about successes and setbacks experienced within the PLATINUM project. Section 17.5 contains a brief conclusion of the case study and an outline of potential future development of the BUT CoI.

17.2. Background, History, and the Team of the BUT CoI

In this section we present the BUT CoI's inquiry into people: building up the CoI team by looking for motivated colleagues who would be interested to get engaged in the IBME project. We report on the background, history and the team of the local CoI at Brno University of Technology.[1] The Central European Institute of Technology,[2] where the PLATINUM project was managed, constitutes the key element of a world-class research infrastructure providing state-of-the-art equipment and ideal conditions for basic and applied research, especially in material science. Teaching activities within PLATINUM took place at the Department of Mathematics in the Faculty of Electrical

[1] www.vut.cz
[2] www.ceitec.eu

Engineering and Communication (DM FEEC). The Department of Mathematics takes care of mathematics teaching for two faculties, the Faculty of Electrical Engineering and Communication and the Faculty of Information Technology. Mathematics courses are usually organised for groups with large numbers of students, ranging from 100 to 800 students with various backgrounds.

History of the BUT CoI started a few years before the PLATINUM project was shaped. The story begins with the series of seminars organised by The Centre for Research, Innovation and Coordination of Mathematics Teaching[3] (MatRIC) in Norway in the spring of 2015 (see Chapter 5). Later that year, the local project coordinator-to-be at BUT gained experience in implementing educational projects through the support of Norway Grants (renamed to EEA Grants[4]). During the years 2015 and 2016, about 20 colleagues and PhD students from the Czech Republic were invited one by one to participate in activities organised within these projects. One of them was Maria Králová who became the local PLATINUM coordinator at Masaryk University (MU). Unfortunately, not many of the other participants demonstrated an intrinsic motivation to put effort in improving teaching and learning of mathematics through educational projects, in particular, no colleagues from the Department of Mathematics.

Taking this situation into account, it was necessary to look for interested participants elsewhere during the preparation of the project proposal. Participation in the project was discussed with two PhD students at the Department of Mathematics and one colleague from the Faculty of Mechanical Engineering (FME) at BUT. All three previously took part in one or more events organised within the Norway Grants. They tentatively agreed to participate in the proposed project and the future BUT CoI. After acceptance of the proposal, the participation of the two PhD students as observers[5] in the classroom was confirmed. On the other hand, the colleague from FME could not confirm participation in the project. The CoI wanted to find one more member. Based on previous experience with successful collaboration, a colleague from Tomas Bata University in Zlín[6] was asked whether she would be interested in participating in the project. The colleague took part in several meetings where the preparation of a joint project proposal had been discussed. She agreed to participate in the project and tentatively promised to participate in some events abroad. So, the BUT CoI line-up had four members by the day that the proposal was accepted and all members had already met people at institutes abroad that participated in the PLATINUM project.

The kick-off meeting in Kristiansand (see Chapter 5) brought a promising launch of the collaboration between the two CoIs based in Brno, the BUT CoI and the MU CoI. This collaboration indeed continued to grow during the first year of the project and is referred to as the Brno CoI. Four large gatherings were organised by the Brno CoI, with topics concerning development of inquiry-based mathematics tasks, organisation of project events, in particular the meeting in Brno in June 2019 (see Chapter 5), and work at the three levels of inquiry in the fundamental model of IBME (see Chapter 2). Besides the large Brno CoI meetings, the BUT CoI had about 7-8 meetings with 2-3 members attending. The purpose of these meetings was to discuss organisation of observation in the classroom, organisation of inquiry-based teaching, and development of inquiry-based tasks. In the second half of the first year of the PLATINUM project, one

[3] `www.matric.no`

[4] `https://eeagrants.org`

[5] By 'observer' we mean a colleague who is present in the classroom/lecture hall during the lesson and collects data about teacher's and students' activity.

[6] `www.utb.cz`

inquiry-based task was tried out with students in three tutorials that were observed. A few more tutorials were observed in which no inquiry-based tasks were present. The outcomes of these observations were very helpful for reflecting on the teaching practice (see Section 17.3). Unfortunately, there is no record of observed data from the spring semester 2019 available, only a template and a few notes made by the teacher based on the oral feedback and discussion. Keep in mind that the PLATINUM project was not completely set up as a research project and that the BUT CoI members had little or no experience with doing educational research.

The end of the first year of the project came with significant changes in the BUT CoI team. Although the meeting in Brno in June 2019 had been perceived as successful and the feedback was positive (see Chapter 5), it became clear that two team members were losing their motivation to continue as members of the BUT CoI. One reason was that they needed to focus on their full-time obligations and did not have enough time to spend on their part-time work as a classroom observer. Luckily, one of the PhD students obtained the degree and became a member of the MU CoI, which meant that the contact between this colleague and the BUT CoI was maintained.

We needed to look for new colleagues to join the BUT CoI, who would do observations of classroom activities. It did not help to ask colleagues from MU CoI as they also had a lack of observers. A few former collaborators were asked, but none was available. Eventually, a new colleague outside the academia was recruited to take responsibility for observing the classroom activity. By the start of the second year of the project, the BUT CoI had three members.

The main focus of the BUT CoI in the first half of the second year was put on inquiry in the classroom activities. A template for classroom observations was developed and many more tutorials/seminars were observed in both Brno and Zlín compared to the first year, some of them introducing inquiry-based teaching units (see Section 17.3). Discussions of what happened in the observed tutorials/seminars were intensive, especially at the four in-person BUT CoI meetings that took place during that period. Traditionally, the nature of the meetings was very informal.

In December 2019, one more formal event took place in Brno. The Brno CoI was hosting the visiting professors Barbara Jaworski and Simon Goodchild (see Chapter 5, Section 5.5, list of meetings). The purpose of the meeting was to clarify the concept of inquiry in mathematics education relevant to the local CoIs (BUT and MU) as well as relating this concept to teaching and learning activities. The visitors and the Brno CoI members participated in classroom observations that were part of the meeting programme. No one could know at that time, but this was the last in-person meeting of the Brno CoI, gathering together about ten participants.

After the BUT CoI meeting in January 2020, part of the CoI moved to an annual meeting with former university classmates. One of them was interested in the project, its activities and outcomes. The contact was maintained during spring 2020, and the colleague became a new BUT CoI member in September 2020 at the start of the third year of the PLATINUM project.

During the third year, in which the COVID-19 pandemic affected the CoI's work, the possibility to meet face-to-face was limited. The local coordinator met with other community members only sporadically. However, the pandemic also brought new possibilities of collaboration. It made the communication between the BUT CoI members more frequent and contributed to strengthening relationships between the members. The frequency of PLATINUM related discussions between the local coordinator and other team members increased to once per week or two weeks. It was more challenging to observe online tutorials, but this also brought a new dimension to the role of observers: without their participation, it would be difficult if not impossible to do experiments and inquire with and in a virtual environment (in our case, MS Teams and MS OneNote). Increased fluency in online communication made it possible to keep a former BUT CoI and MU CoI member who moved abroad engaged in the BUT CoI activities informally. On the other hand, absence of the face-to-face meetings with the members of the MU CoI led to a less intensive collaboration within the Brno CoI. Everyone was too busy with coping with their work under new circumstances and had little time left. Only one virtual meeting of the Brno CoI was arranged in 2020. However, representatives of both local CoIs kept in touch and the status quo seemed to be sustainable beyond the PLATINUM project. By the end of the third year of the project, the BUT CoI had four members and this line-up seemed to be stable enough to continue after the implementation period of the project. There was also a chance that the BUT CoI will have one more member by the end of 2021.

We summarise the development (nature, form and activity) of the BUT CoI during the three years of the PLATINUM project.

First year:

- 4 members (1 teacher in Brno, 1 teacher in Zlín, 2 observers in Brno);
- regular F2F meetings of (only Brno) members (once in a month including joint meetings with the MU CoI);
- discussions about inquiry tasks and event arrangements, discussions about the nature of inquiry in IBME;
- little classroom activity (7 tutorials observed in Brno, 1 inquiry-based task in 3 tutorials in Brno).

Second year:

- 3 members (1 teacher in Brno, 1 teacher in Zlín, 1 observer in Brno);
- less F2F meetings but all CoI members (once in a month before COVID-19), regular online and phone discussions (once in 1-2 weeks during COVID-19);
- visit to the Brno CoI by Barbara Jaworski and Simon Goodchild;
- discussions about inquiry teaching units, evaluation, and inquiry-based mathematical modelling;
- more classroom activity (26 tutorials observed in Brno, 4 tutorials/seminars observed in Zlín, 2 inquiry units in 3 of the 4 seminars observed in Zlín).

Third year:

- 4 members (1 teacher in Brno, 1 teacher in Zlín, 2 observers in Brno) + 1 remote member;
- two F2F meetings of (only Brno) members, regular online and phone discussions (once in 1-2 weeks both during and after the teaching periods affected by the COVID-19 pandemic);
- discussions about inquiry-based mathematical modelling, evaluation and IBME activities in virtual environment;
- virtual classroom activity (40 tutorials observed in Brno, 1 inquiry-based modelling task in 3 recorded tutorials in Zlín).

17.3. Contribution of IBME to Reflective Teaching

In this section we present the BUT CoI's inquiry into mathematics teaching and learning: development of teaching approaches, teaching units, observing templates, questionnaires, and other relevant outcomes.

As far as the BUT CoI members remember, we encountered the idea of IBME and developmental research at the MatRIC seminar in Kristiansand in May 2015 for the first time (see Chapter 5 for details). It was Professor Barbara Jaworski who presented the topics at the MatRIC seminar. Later we had the opportunity to listen to similar presentations given by Barbara Jaworski at several more occasions (Loughborough September 2015, Trondheim November 2015, Brno February 2016, Loughborough September 2016, see Chapter 5). It means that we knew the theoretical basis of IBME and the developmental process well. However, we found it difficult to link the theory to our own practice of teaching mathematics at a university. One of the community members met another practice of IBME before the PLATINUM project had started:

> I first met the concept of Inquiry-Based Mathematics Education in 2016 at the meeting of Czech mathematics teachers in Srní, and then in 2017, I attended a one-hour workshop at an event in České Budějovice. The workshop was based on physical manipulation with geometric objects, observing their properties and classifying them. And also, my first idea of IBME was, in fact, joined mainly with manipulations and 'do it yourself' things rather than mental activities.

The PLATINUM CoI started a practical discussion about Inquiry-Based Teaching and Learning at the kick-off meeting in Kristiansand in September 2018 (see Chapter 5). The fundamental three-layer model of inquiry was introduced (see Chapter 2). However, it was not clear to the BUT CoI members how to put it into practice. One of the members reported in a narrative:

> I did not understand what it actually means, hence I decided to focus on reflecting on inquiry-based mathematical tasks and the particular course where I would use those tasks.

A similar situation occurred at the PLATINUM workshop in Madrid (see Chapter 5), with the tiny difference that the BUT CoI started to realise that nobody would tell us what IBME actually is. The answer to the question "What is the inquiry?" has always been the same: "It depends on what you want to achieve." One BUT CoI member recalled how puzzling it was:

> This time, it was more about inquiry in mathematics education. I was asked a tough question: What do I want to achieve? What is my inquiry? I did not know the answer, and I was assured that nobody else could answer it for me. I had no idea what my inquiry question could be, which on top of all that should be researchable.

Another BUT CoI member recalled similar feelings with a different conclusion:

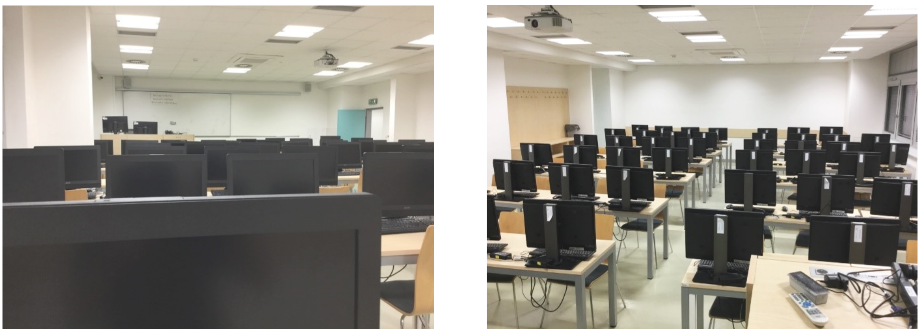
> Though I had no expectations, I must admit that I was a bit surprised that I did not get the answers to my questions yet. It looked like all of us need to reinvent the basis of IBME, namely the notion of inquiry itself, again for ourselves. So what do I think that is inquiry and inquiry-based activities? Now I feel it this way: inquiry-based activities are such that given proper motivation and needed tools, students who are at least a bit engaged are about to act and react in order to solve the given problem.

After the return from the Madrid meeting, it was time for the first observed experiment at BUT. At the beginning of the project, there was a discussion about collecting data and GDPR. BUT CoI decided to do classroom observations without video recording to avoid necessary formal requirements. Observations were to be done in the form of collecting anonymous data in the format of written notes. A template for classroom observations was proposed and agreed.

The classroom setup chosen for the observations was a tutorial with 30-50 first-year electrical engineering students, mostly male, in a computer lab (see Figure 17.1). Each student has an all-in-one computer, a keyboard and a mouse. There is little space for a notepad, textbook, etc. Screens are large, so students can 'hide' behind them. The teacher desk stands on an elevated platform in front of the classroom, 50 centimetres above the rest of the room. One whiteboard located in the front can be slid in the left/right direction. If it is slid to the right, the projection screen covers most of the whiteboard.

The topic of the observed tutorials in the first year of the project was calculus of complex functions in one variable and complex contour integration. One inquiry task was handed out to the students: the complex cosine (see Figure 17.2). The task was intended to be flexible enough to make it possible for the students to choose the level of inquiry that suited them: structured inquiry, guided inquiry, or open inquiry (see Section 6.2.1; Banchi & Bell, 2008; Wenning, 2005). The task was presented in the way of guided inquiry, that is, the teacher provided questions only and it was up to students to find their own approach to the questions. The order of the questions was partially structured, but the students had the freedom to start with any question with the possibility to introduce their own questions. If they did not get an idea how to proceed, the students could use support of the teacher.

The outcomes of the experiment were mostly as expected—students tried to "guess the correct answers"—with a few exceptions regarding students' own questions. However, as one of the observers reported, most students actively engaged with the task: "We were pleasantly surprised that students actively discussed prepared questions." The word *actively* here means that the students actually were working and discussing



Student view Teacher view

FIGURE 17.1. Computer lab setting for tutorials at BUT, DM FEEC.

FIRST NAME & SURNAME

The function of complex variables $\cos z$ is defined as follows:

$$\cos z = \frac{e^{jz} + e^{-jz}}{2}$$

Questions:

(1) What can we feed as input into $\cos z$? (What is the domain?)
(2) What can be at the output of $\cos z$? (What is the range?)
(3) Does the function $\cos z$ have any zeroes (points where $\cos z = 0$)? If so, where are they located?
(4) Does the function $\cos z$ have a derivative? If so, where (on which subset of the domain)?
(5) Is the function $\cos z$ somewhat " related" to the real function $cosx$?
(6) How can we imagine/visualise the function $\cos z$?
(7) My own question (to the topic):

FIGURE 17.2. An inquiry-based task on the complex cosine function.

the prepared questions, which was in contrast to the usual students' practice of copying information written on the whiteboard passively.

Questions and ideas related to inquiry in teaching started to emerge after a few observed tutorials. The observations were literally an eye-opener. The teacher described his experience as follows:

> If you practise the 'traditional way of teaching'—calling students to the whiteboard or calculating yourself—and there is no one observing the classroom activity, you have absolutely no idea what is going on in the classroom!

The observation we considered as particularly important was that when the teacher dealt with a student at the whiteboard and the progress was slow, other students in the classroom got bored quickly. To prevent this undesirable behaviour, a sequence of modifications of teaching activities was made up and tried out. The experience was summarised in the following narrative:

> So I started to call volunteers. It worked for one tutorial. Then they stopped raising hands. So I started to ask students for suggestions and I did the calculations following their suggestions. If it didn't work, we started again with another suggestion. It worked for one tutorial. Then they stopped giving suggestions. So I posed the problem and let them reflect for a few (2-3) minutes. Then I asked for suggestions, and for each suggestion I called a volunteer to the board. It worked for one tutorial. Then they stopped giving suggestions. So I posed the problem and let them work on it for longer time (5-10 min). I walked among the students, gave suggestions and tips and I was available for questions. When a student was done, I asked them to present their solution on the whiteboard.

Another observation, important for the students, was that the teacher should speak loudly with face turned to the students in such a large classroom and had to learn writing in an accessible way (capitals, large symbols). After an observed tutorial, a brief meeting of the BUT CoI usually took place. The purpose was to give immediate feedback to the colleague responsible for the tutorial. Sometimes a longer discussion took place, for instance about the nature of inquiry. One of the observers expressed the opinion that "inquiry is a form of self-evaluation." One of the teachers recalled the struggle with inquiry during the spring semester 2019:

> After about a month of frustration, one day I woke up in the morning and I knew what my inquiry is. There were actually two of them. My primary inquiry is concerning 'weak' students. Why do they do incorrect steps? Don't they understand the algorithm? Don't they understand which objects they are dealing with? Don't they know the properties of the objects? Don't they know what is it good for? My secondary inquiry is about the students without any difficulties. What to offer them that could bring benefit to them and promote inquiry at the same time?

At the end of the semester, the CoI discussed a possibility of students' feedback. The survey was partly closed, asking to rate particular teaching activities, partly open, asking the students to express what was good and what could be improved (see Figure 17.5 for an example of a short questionnaire). Analysis of the responses showed that the most and the least popular/liked teaching activities were what we anticipated: the most popular activity was that the teacher performs all calculations on the whiteboard and the least popular activity was that the teacher calls students one by one (not by names) to the whiteboard to work on tasks. The inquiry task shown in Figure 17.2 was the second lowest rated. One reason for that might be that the students were not used to such type of tasks and teaching activities and preferred to stick to what they were used to.

One of the observers reported about impact that the activity in PLATINUM had on her teaching:

> Thanks to the knowledge from the PLATINUM project I continued trying to change my way of teaching. My main goal was to show students that at least mathematical basics aren't hard to understand and there is nothing to be afraid of. I was focused less on pace in teaching during my classes (sometimes it was necessary to go faster due to big amount of material for one class), but more on students' understanding of concepts, on their ability to connect one topic with another. And even though it was still with mainly basic exercises from previous years, I tried to make it at least a bit inquiry and not only receiving of facts.

Another inquiry emerged after the spring semester had ended. The teacher recalled:

> After a further month of reflection and a discussion with Yuriy (Rogovchenko), I came up with another inquiry. This time, it was an inquiry in teaching arrangements. Given the context—room arrangement, equipment, number of students, topic to be taught—how to arrange activities in the classroom so that the students, I mean, my students, get the optimal combination of learning content and learning experience?

This inquiry indicated one of the directions/primary goals of the BUT CoI for the second year of the project. It also matched the idea of differentiation, defined by Petty (2014) as "the process by which differences between learners are accommodated so that all students in a group have the best possible chance of learning."

Due to the BUT CoI changes, a new observer in Brno was recruited at the beginning of the fall semester 2019 (see Section 17.2). The new colleague recalled that in the beginning she had doubts about her contribution:

> I was aware that I am not a student that would understand mathematics through teaching methods that are applied at universities standardly. I thought that I am not able to contribute to the project.

The renewed CoI discussed what could be its inquiry into teaching and learning, and what kind of outcome of the observations would be helpful for that inquiry. One of the members recalled:

> In the beginning, we wanted to know what the students actually do during the class. Who interacts with the teacher or with the neighbours, who shows any reaction to a teacher's activity and how they react, and what the students do when they don't participate actively in the class.

One of the main purposes of the inquiry into the student activity was to find out how to engage the students in the classroom activity, in mathematics. It turned out that there is a need to study/measure two main types of activity: activity of the teacher and activity of the students. Both types were considered worthwhile to be studied in more detail, as well as interactions between the teacher and the students and amongst the students. A template, available on the PLATINUM website `https://platinum.uia.no`, was proposed that would be convenient to collect the data that was considered as useful: location of the students, who communicates with whom, whether they use PCs or not, what they use the PC for (learning or other activities), whether they use mobile phones and for what. This type of data provided required information—how students reacted on various attempts of the teacher to engage them in the classroom activity—and served as a source/reference during the after-class discussion because it was easier to talk about particular students according to the location they occupied. The template was developed through the semester and further data fields were added: number of sets of tasks, number of tasks in each set, how many times did the teacher walk around the classroom, how many students did the teacher talk to, how many students raised hand when a question was posed, how many times did a student ask the teacher for help, and how many times did a student take a photo of the whiteboard.

Observing the classes and analysing the classroom activity had a lot of consequences to form and content of the teaching activities. It was possible to see which students prefer collaborative work and which prefer to work alone, what resources they use, how they find them, and how they work with them. It was clear immediately after the first tutorial that the teacher must come to the classroom a few minutes before the class and air out the whole classroom. The observers' work had essential impact to the change of teacher's behaviour. The observations indicated that the teacher should possibly

- speak loud and clear, with confidence and face turned to the students;
- walk around the classroom and talk to students even if they do not ask;
- repeat briefly the main points/highlights of the lecture;
- write the list of tasks for the next week on the whiteboard;
- write in capital letters, and as large as possible;
- leave the students a short time to reflect after posing/asking a question;
- look prepared and determined; and
- formulate instructions clearly and in simple terms.

In the middle of the fall semester, the BUT CoI was invited to visit and observe two inquiry-based seminars at Tomas Bata University in Zlín (see Section 17.2). The classroom setup of sessions observed at the university in Zlín in November 2019 was different from the setup at BUT in Brno. The format of the class was a seminar with elements of lecture, tutorial, and group work. Each group consisted of about ten first-year engineering students, both male and female. Students had no computers, which left enough space on the desk for resources and notepads. The teacher's desk was on the same floor level in front of the classroom, attached to the first row of student desks. Two whiteboards located in the front and a projection screen were arranged such that they did not cover each other (see Figure 17.3).

FIGURE 17.3. Student view within the classroom setting at Tomas Bata University in Zlín.

The topic of the inquiry-based teaching unit observed in Zlín was an introduction to derivatives and is available on the PLATINUM website. The main aim of the lesson was to introduce the concept of the derivative of a real function of one variable at a point with an emphasis on understanding its geometrical interpretation. Four inquiry tasks were given to the students during the seminar. The students first worked alone but were encouraged to discuss with neighbours and the teacher, and gradually worked in pairs or small groups. The nature of the inquiry was guided, structured, and scaffolded. The inquiry-based seminars were each time followed by one more inquiry task in the lesson next day.

A brief CoI discussion took place after the two observed seminars. The observers from Brno found the seminars interesting and inspiring in both the format and the content. The combination of lecture, tutorial and group work, together with the more personal approach of the teacher to the students facilitated to maintain the dynamics of the lesson. A positive observation was that all the students actively participated in both seminars. After the observers' notes were shared with the teacher, she could not hide surprise at certain points: "Have I really said/done that?" It suggests that sometimes teachers are so immersed and excited during the teaching activity that they do not perceive/remember all details about what they say.[7]

The visit of Professors Barbara Jaworski and Simon Goodchild to the BUT and MU CoIs (see Section 17.2 and Chapter 5) had significant impact on the BUT CoI, its goals and activities. An important outcome was the decision to split the case studies of BUT and MU (see Chapter 13). Further, all participants had the opportunity to observe an inquiry-based task in a statistics tutorial at MU. Finally, the BUT CoI hosted Barbara Jaworski and Lukáš Másilko (from the MU CoI) as observers in one tutorial. This unique experience brought two important reflections: (1) feedback from outside is very useful regardless of language barriers, and (2) the students behaved and performed better in the presence of guests. The CoI members had an inspiring discussion with Barbara Jaworski after the tutorial. The topics were how to bring more inquiry into the lesson about infinite series, how to arrange activities so that the students come prepared and are ready to discuss mathematics, and how to avoid/replace manual assessment of a large number of written tests/exams. Based on the discussion, the goal for the spring semester 2020 was set, namely to try the flipped classroom principle (Fredriksen, 2020) to create time for student inquiry in learning mathematics in class. Although there was no possibility of using Computer Aided Assessment (CAA) systems for assessment due to the subject arrangements, the BUT CoI considered to at least try to support students' learning at home by CAA. The idea was supported by the classroom observations that revealed that students use computational software like computer algebra systems anyway.

Checking the students' results in the final exam brought a surprising insight: the form of active learning (Freeman et al., 2014) practised during the fall semester did not have any significant impact on the students' results. This was perceived as a failure because the CoI expected that more active engagement of students would bring improvement in results. Based on the chosen goal, the CoI started the spring semester 2020 with a combination of active learning and flipped classroom. However, neither this combination worked as expected. Although the students were told that they must come prepared for the next class and got clear instructions, most of them did not have a look at the specified topic. However, the students seemed to be OK with solving the given tasks themselves in the classroom. One student commented: "Better a tutorial where I solve tasks than a tutorial where I just sit."

The next in-person meeting of the BUT CoI took place in Zlín in March 2020. The CoI met in Zlín to observe two seminars, one of which was planned to be inquiry-based. Classroom setup of these sessions (shown in Figure 17.4) was similar to the setup in fall 2019 (see Figure 17.3 on p. 315). The format of the inquiry class was a seminar with elements of lecture, tutorial and group work, while the other class was close to a standard tutorial with students coming to the whiteboard one by one. Each group had about fifteen first-year engineering students, both male and female in the inquiry

[7]It seems there has not been done much research in this direction yet.

class, and only female in the other class. Students had no computers. The teacher desk was more or less on the same floor level (but not above) in front of the classroom either attached to the first row of student desks or with a small gap between. Two whiteboards were located in the front and a projection screen was arranged such that it did not cover the whiteboards.

FIGURE 17.4. Another classroom setting at Tomas Bata University in Zlín for a seminar.

The topic of the inquiry-based teaching unit observed in Zlín was an introduction to definite integrals and is available on the PLATINUM website. The main aim of the lesson was to introduce the concept of the definite integration and its geometric interpretation. Four inquiry tasks were given to the students during the seminar. The students first worked alone with tablets provided by the teacher but were encouraged to discuss with neighbours and the teacher, and gradually worked in pairs or small groups. The nature of the inquiry could be labelled again as guided, structured, and scaffolded, but the first two tasks actually allowed students to explore a variety of approaches. The content accessed through the tablets was arranged in the university learning management system (MOODLE).

A brief CoI discussion took place after the two observed seminars. Again, the observers found the inquiry seminar interesting and inspiring in both the format and the content, and the combination of lecture, tutorial and group work, together with the more personal approach of the teacher to the students facilitated to maintain dynamics of the lesson. The non-inquiry seminar was also inspiring with respect to its format, but not regarding its content, namely, integration by partial fraction decomposition. In that seminar, the students tended to use mobile phones for communication outside the classroom more often. One of the outcomes of the discussion was the conclusion that there is no universal way of teaching that would be optimal for every student and under all possible circumstances.

The first COVID-19 lockdown happened in the middle of the spring semester 2020. The teacher and students in Brno benefited from the choice of the flipped classroom approach because the students exposed to this approach adapted to individual work at home quickly and were less shocked than the students taught in the traditional way. Although some students did not like the flipped classroom approach before the COVID-19 pandemic, they admitted that it helped them during the lockdown: “I did not like the (flipped classroom) activity, but it was a good preparation for the distant learning.” The students said that initially they did not like the flipped classroom approach because they spent time working at home and it took them longer time than working in class.

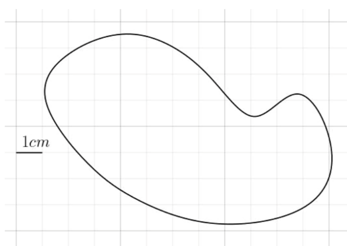
After the spring term 2020 affected by the COVID-19 lockdown, the CoI discussed the teaching experience and students' results. One of the teachers expressed the satisfaction with students' results because 84% of the students passed the exam. That led to the following discussion about the teaching goals which contributed to the change of that teacher's perspective. Teacher 1: "Once you give marks to students, it changes your point of view towards the goals. In particular, no longer will be your goal (just) that the students pass the exam." Teacher 2: "True. If a talented student comes to try to pass without effort and be satisfied with E, I will let them come back again."

Another outcome of the observation visit to Zlín was the development of an evaluation tool for the inquiry-based teaching unit *Introduction to Definite Integrals* observed in the classroom (see Figure 17.5). The purpose of the questionnaire was to evaluate students' understanding of the concept of the (Riemann) definite integral. Forty-four students filled in the questionnaire between 2 and 3 months after the observed seminar. Their answers showed that more than 90% of students had successfully formed an idea of the concept and symbolisation of a definite integral and what can be calculated with it. One third of students were able to combine the idea of the definite integral with a practical task. But most would still prefer a less sophisticated method/procedure to calculate/estimate the area of a general shape. According to the results of Question 3, students (almost 90%) did not understand the underlying concept on which the definite integral is based or did not absorb/recall the terminology used. Concerning the work with tablets, most students responded that they were used to digital technology, which supported inclusion of such activities in the teaching design.

Questionnaire – Definite Integral

1. What do I understand/imagine under the notion/symbol of the „definite integral" $\int_a^b f(x)dx$? What do I expect/imagine that I am able to calculate using the „definite integral"?

2. How would I proceed to find/determine area of the shape inside the curve in the picture?



3. What comes to my mind when I see/hear the term „upper/lower sum"?
4. In some classes/seminars we worked with touchscreen devices. Rate the level of work with tablets and electronic materials.

☐ Very easy ☐ Easy ☐ Normal ☐ Difficult ☐ Very difficult

5. What would help me understand/learn math better?

FIGURE 17.5. The questionnaire related to the teaching unit *Introduction to Definite Integrals.*

After summer holidays in 2020, the focus of the BUT CoI discussions changed towards mathematical modelling. The reason was that BUT was one of the three partners in the project Intellectual Output (IO) *Mathematical modelling teaching resources from real-world problems in business, industry and society* (IO5, see Section 5.4

for the list of IOs). It is important to say that BUT was the partner that had least experience with using mathematical modelling as a learning activity. Two CoI members participated in regular meetings of the IO5 team that included up to nine participants from four universities in four countries (see Chapter 8). At that point, there was a lot to learn from the other partners, but less to contribute: theoretical ideas and personal reflections/opinions without practical experience.

Based on a real-life application, one inquiry-based modelling task was proposed, where a wheeled robot was supposed to be programmed to detect source(s) of radioactive radiation in an unexplored area of polygonal shape. The students would be encouraged to compare different solution strategies and determine an optimal trajectory of a robot to scan at least 50% of the area at least twice. Expectation was that the students would use their knowledge of linear algebra, calculus, optimisation methods, control theory, and engineering to deal with the task. However, that also implied that the task should be presented to students at master's level which none of the teachers in the BUT CoI taught or was going to teach.

Discussion about practical experience in mathematical modelling at the BUT CoI was set aside because of the start of the new semester. Fall 2020 brought another type of inquiry: inquiry into challenges induced by COVID-19 restrictions. One of the former observers who kept in touch while living abroad described the spirit of the COVID-19 restrictions period as follows:

> I've stayed in contact with my former colleagues as all of them were working online anyway, so it was easier and more natural for this time to be in touch even while being in different countries.

At both universities where the BUT CoI members worked, there was an inquiry into remote teaching activities and students' remote learning. Discussions within the CoI were often related to the 'degree of freedom': while teaching arrangements were up to the person responsible for a subject in Brno, there was a whole university teaching policy in Zlín. The teachers in Zlín had to be online during the scheduled classes and had to actively engage with their students for at least half of that contact time. The colleague teaching in Zlín had chosen a blended approach: lecture-like content delivered to the first group of students was recorded while in other parts of the class students worked on tasks with the possibility to ask and discuss with the teacher, but those parts were not recorded. The other groups of students watched the recorded video of the lecture-like content and then again worked on tasks with the possibility to ask and discuss with the teacher. It appeared to be a good practice for the smaller groups of 10 to 20 students in Zlín.

The BUT CoI grew a little at the start of the fall semester 2020 (see Section 17.2). A new colleague in Brno joined the CoI as an observer. She expressed her motivation to join the CoI as well as her feelings about it in a narrative:

> I have spent 16 years on maternity leave with 5 kids. I did not think I would ever get back to university mathematics. I have reflected for a few years on where and how would I find a job. An invitation to participate in the PLATINUM project came unexpected and sooner than I could start looking for a job. The idea of an inquiry-based approach fitted perfectly to my idea of effective learning. My enthusiasm that I can do something that I like so much was mixed with my worry whether I will be able to do that.

One of the CoI discussions was related to development of an evaluation tool for the inquiry-based teaching unit *Introduction to the Derivative* developed and tested the year before in the classroom. The purpose of the questionnaire was to reveal students' understanding to the concept of a derivative. The questionnaire was designed and used in a similar way as the questionnaire on definite integrals (Figure 17.5). Although the results of the questionnaire showed that the students' understanding of the concept was lower than expected, the questionnaire itself proved to be a useful tool: it helped to identify which conceptual details were not clear to the students and how the teaching unit could be improved to fit better the virtual teaching and learning environment (in our case MS Teams). The discussion of mathematical modelling in teaching mathematics was reopened when the derivatives were introduced and practised in Zlín. The teacher in Zlín proposed a modelling task: "Given the volume of 0.5 litre of a liquid, minimise the material needed to make a can that would contain the liquid." This task was tried out in three lessons with groups of 6 to 12 engineering students in a virtual environment. Experience from the three lessons as well as the teacher's reflection is described in Section 8.4.2 in more detail. Introduction of online tutorials in Brno in the second part of the semester brought an opportunity for observers to participate in the virtual meetings and make notes/collect data. Most of the tutorials had a stable proportion of participants: about 20% of all students in the group. That makes less than half of regular participants, compared to the in-person lessons. Sometimes it was difficult to engage students. The teacher reflected on the experience: "It was frustrating to talk to the screen, seeing nobody and hearing nobody, and getting answers to only the simplest procedural questions after two or three invitations." On the other hand, the observing CoI member wrote on the observation sheets:

> I realised that some things are more important in online communication. In the real classroom, it is good if the teacher describes what is going on. The students can see that the teacher is reflecting or preparing to write something on the whiteboard. Similarly, after a question is posed, the teacher can see if the students need more time, or if they are not preparing to answer/reply. In the online tutorial, especially by screen sharing, it is important that the teacher comments on everything. Otherwise, awkward silence can occur.

An advantage of the online tutorials was that the time was announced and a meeting in MS Teams was arranged in advance, so the students could choose to contribute to the content of a tutorial by asking particular questions in the MS OneNote classroom notepad or in the MS Teams team channel. However, only a very limited number of students made use of that opportunity. Most of the students preferred either a private chat with the teacher or to remain silent observers. Yet the students saw benefit in the online tutorials, so the teacher's initial aversion turned into fondness in the end.

17.4. Challenges, Achievements, and Experiences of the CoI

In this section, we summarise experiences of the BUT CoI from five semesters of reflective teaching. We present the BUT CoI's inquiry into community: lessons learned by the teachers and observers. A summary of challenges encountered, the means and measures taken to get over the challenges, and the information about which of the challenges have been successfully overcome, may provide deeper insight into the character and experience of the local Community of Inquiry. Reflections of the CoI members illustrate what they perceived and how they thought about activities and ideas related to IBME and PLATINUM. We also include narratives and ideas related to the impact of the COVID-19 pandemic on education.

17.4.1. Challenges, achievements, and experiences in CoI and IBME development. We present a summary of challenges encountered, how they were overcome, and what was the CoI's experience with IBME.

***Challenge 1**: Building up a local CoI.*

Achievement: The working style of the BUT CoI has always been informal and open. Thanks to careful considerations of whom to invite to join the local CoI (and a little bit of luck), the CoI has become sustainable and keeps growing slowly.

Experience: It is essential to find colleagues who have intrinsic motivation in teaching mathematics or mathematics education in general. It is far less important how far they live. In fact, the BUT CoI is institutionally independent as it is based on trust and personal relations.

***Challenge 2**: Linking the theoretical model (Chapter 2) to the CoI's practice.*

Achievement: The CoI's understanding of the fundamental three-layer model is more intuitive and less theory-based. However, the CoI members agreed that it is important to include all three layers into the CoI activities. That has been achieved by including the observers into the community and feeding the outcome of the observations back into teaching practice.

Experience: For other colleagues than those into mathematics education research, it might be difficult to understand the theory in full and/or link it to their own practice. However, it is important to never give up and keep discussing within the local CoI as well as with other colleagues outside the CoI, within or outside the institution.

***Challenge 3**: Defining goals of the local CoI ("What is my inquiry?").*

Achievement: It was not easy to define goals for the CoI when the structure of the CoI is not hierarchical (see Chapter 3, spiderchart *group of inquiry*). However, the main goal of the CoI members was clear from the very beginning: to develop their own teaching practice through engagement with different types of inquiry. The BUT CoI case study presents the history of that development.

Experience: The development of CoI goals usually reflects understanding of the three-layer model (Challenge 2). It might happen to start with the question "What IBME tasks could we prepare for the students?" and continue through "How can we improve our teaching practice to enhance students' learning/conceptual understanding?" to get to "How do we evaluate the outcome of a lesson where an IBME teaching unit was applied?". It is realistic to expect going even further in the future.

***Challenge 4**: Finding space for IBME tasks in a tight teaching schedule.*

Achievement: Heavy teaching load was an issue in the CoI because the two mathematics departments in Brno and Zlín are perceived as 'service teaching' departments. Yet the CoI experimented with inquiry-based tasks in two different classroom setups and in a virtual environment as well.

Experience: Everyone can make it if one wants to. There is always some space to develop and test at least one task that is in agreement with the teaching syllabus. It is easier to include inquiry-based teaching units if the teaching schedule is less tight and one has freedom to choose the teaching format and content.

***Challenge 5**: Developing the process of observing in the classroom that would be as simple as possible and provide the information needed.*

Achievement: The BUT CoI found an observing practice that is convenient for achieving the goals of the CoI and that is in compliance with institutional rules and current legislation (GDPR). Observation templates not including personal information were developed that could be easily adapted to any class of up to seventy students.

Experience: It is an advantage if classroom observations can be made regularly. New observations can lead to innovations in the classroom activity: modifications of content, changing teacher's behaviour, introducing new activities to engage more students or to engage them in more depth.

Challenge 6: *Engaging students in the classroom activity including those who actively resist to various forms of engagement because they do not want to be engaged.*

Achievement: The CoI observations suggested that between 10% and 20% of students did not appear to be engaged. The student resistance was overcome successfully by convenient arrangements. The 'proof of concept' was observed during the visits to Zlín. When there was a small group of students in a classroom on campus with an active teacher, it was difficult for the students to resist. The teacher knew each student by name and could recognise in a few lessons if there was any problem.

Experience: Students often do only what they have to. It is therefore important to decide what *we* (teachers) want them to learn/achieve/develop, and to foster it by arranging the conditions to pass the subject so that they fit the teaching goals.

Challenge 7: *Designing inquiry-based activities that encourage students to learn and promote students' conceptual understanding.*

Achievement: The CoI developed and tested two IBME teaching units, one inquiry-based modelling task and one self-standing inquiry task. Another inquiry-based modelling task has been developed, but not tested yet in practice.

Experience: Compact IBME teaching units seem to have largest positive impact on conceptual understanding of the students. Modelling tasks seem to promote collaboration/group work also in a virtual environment.

Challenge 8: *Including digital technology into the IBME activities.*

Achievement: One of the IBME teaching units developed by the BUT CoI was handed out to students through the Learning Management System (LMS) Moodle. This unit implicitly assumes that students have access to convenient digital technology. The unit was tested in Zlín where the students used touch devices brought to the class by the teacher.

Experience: Modern computational software is capable to perform many of the calculations that we traditionally ask students to do with pencil and paper. It is beneficial for both students and teachers to explore the possibilities of such software and incorporate its use in educational activities rather than pretend that such software does not exist. It seems to be more acceptable by both students and teachers to use software nowadays than it used to be before the COVID-19 pandemic.

Challenge 9: *Developing questionnaires and surveys convenient for evaluation of conceptual understanding and for collecting students' feedback and suggestions.*

Achievement: The CoI prepared a number of surveys, both on paper and online, to collect students' views on teaching and learning activities, both in-class and online, on the study of mathematics for engineers in general, and on their self-evaluation. Two evaluation questionnaires were developed to examine students' conceptual understanding acquired through the inquiry-based teaching units in a long term. Data collected were both quantitative and qualitative.

Experience: Feedback from students is very important. They often have a clear idea what could be helpful for them in learning mathematics. That way the students can contribute to teachers' better understanding of student needs and optimisation of teaching and learning activities.

Challenge 10*: Finding ways to share our experiences with colleagues who are not interested in inquiry-based mathematics education.*

Achievement: The BUT CoI has not succeeded in addressing this challenge yet. We are aware that in the busy schedule of service departments, this is a big challenge.

Experience: It is often easier to share experience with colleagues who do not teach mathematics but teach other subjects, or do not teach at all. People who are not into mathematics are often interested in approaches to learning and teaching mathematics that they are not familiar with.

17.4.2. Reflections of the CoI members about their engagement in the PLATINUM project and IBME. There were many 'lessons learned' by individual BUT CoI members. These elements contributed significantly to the development of the CoI as a whole. Some of the observations and reflections can be found in the following collection.

Reflection 1*: Importance of a non-teacher perspective.*
"It is helpful to engage people who do not teach mathematics, and perhaps who do not teach at all, in design of learning and teaching activities. They have different experience with mathematics, which is difficult to imagine if one has never gone through it."

Reflection 2*: Complementarity of the students' perspective.*
"I was pleased that the experience from my own education—so different from the other colleagues in the BUT CoI—can be helpful to deal/work with some of the students who might have similar experience/attitude as I had when I was a student. I remember where I made mistakes and what piece of information I skipped as not important. For example, thank to that experience we were able to design tasks for tests and exams in such way that it was more difficult to copy solution from others." (cf., Section 12.5)

Reflection 3*: Advantage of international collaboration.* "I like the overall idea of an international project in education. Eight universities from seven countries work with the same idea and each team (local CoI) fits the idea to local conditions and investigates it in its own way. Teams and the members do not compete but collaborate. My favourite childhood TV show was 'Games Without Borders',[8] and PLATINUM is like the highest level of it where the whole international community wins."

Reflection 4*: Observer's feedback to the teacher's activity.*
"I liked observing the teaching activity when the teacher gives a set of tasks and then walks around the classroom and supports students in their efforts. I especially appreciated that the teacher kept explaining the students that it is good for them to ask questions. What a contrast to my experience from primary and secondary school where asking questions was considered a weakness or a lack of ability!"

Reflection 5*: Students' struggle to accept 'learning by mistakes.'*
"It was difficult to pass to the students the idea that humans learn by mistakes and that they should perceive mistakes positively to some extent. A mistake would make the students reflect on why did they made it and what to do to prevent it next time. We invited them to practice clapping hands in couples in specific patterns in a fast pace, a game we have learned at a design thinking workshop. However, the students rather slowed down the pace to avoid making a mistake."

[8] https://en.wikipedia.org/wiki/Jeux_sans_frontières

Reflection 6: *Consequences of denying 'learning by mistakes.'*
"We observed that this 'fear of making a mistake' led to a sequence of undesirable consequences:

(1) If I don't know, I don't even try.
(2) If I don't try (at home), I don't know what to do in the class.
(3) If I don't know what to do in the class, I don't ask because it might reveal that I didn't prepare at home.
(4) If I don't ask, I miss the chance to clarify and understand.
(5) If I don't understand, I am leaving it until the preparation for a test/an exam.
(6) If I have left it to the time when I prepare for the test/exam, I don't ask because it will reveal that I did not study what I should have learned.
(7) If I have never asked and understood, I don't pass the exam.

Such behaviour—postponing a problem instead of facing it—is a waste of time and harms the student."

Reflection 7: *Lack of interest of the (engineering) students in learning mathematics.*
"Part of the students who do not engage in the classroom activity occupy themselves with other subjects. Perhaps they consider other subjects more important than mathematics. However, doing this they are not taking the opportunity to learn what is going on in the classroom right now. Another part of the students is active on social networks or browses the internet thoughtlessly. That is the ultimate waste of time. These two groups might represent about 20–30% of the students."

Reflection 8: *Students' (non-)readiness to participate in tutorials.*
"Many students come unprepared to the tutorial. One of the reasons that the students are not prepared might be the size of the group. The students might have the feeling that they do not need to prepare because there are many other students to be asked to say something. Reducing the group size might help. On the other hand, students who come prepared to the tutorial are often prepared to help other students in the classroom."

Reflection 9: *First-year students' (dis)orientation in how to study.*
"The students are in their first semester at the university. They have no idea how to study. Some of them cannot 'google' the resource even if I write the query on the whiteboard. They don't know how to work with formulas that they have on their cheat sheet, or how to use one task to find solution to a similar one. I spent a lot of time to teach them how to study. I think that it might be the biggest outcome of the mathematics tutorials for some students."

Reflection 10: *Students' quick accommodation to the observer's presence.*
"It is not necessary to sit on a chair among the students. The students perceived my presence in the very beginning, but after the teacher explained the purpose of my presence, I became unnoticed, like a ghost. I moved along one side wall and the back wall to have a good view of their screens. I did not talk to them and they did not talk to me. Definitely, my presence did not scare them off from browsing the internet, pursuing other subjects or doing nothing at all."

17.4.3. Changes in the work and life experience of the CoI during the COVID-19 pandemic. About half of the PLATINUM project took place during the COVID-19 pandemic, which brought challenges to people's lives that had to be taken into account seriously. The BUT CoI members commented on issues related to keeping work/life balance, switching to digital teaching/learning environments, increasing volume of online communication and longing for on-campus activities in the following narratives. One of the big new challenges was how to keep a good balance between work and life. A CoI member reported:

> The biggest challenge is the time management: how to find a place and time for work at home, and to keep enough time for the children and my own sleep. Especially now, when the schools and free time activities are open and closed in various combinations every week, it is difficult to find time for regular work.

Due to COVID-19, new arrangements had to be made, resources prepared, and equipment purchased in order to provide students with teaching and learning activities in different learning mode. Another CoI member noticed:

> EU and other countries have spent a lot of money on digitalisation of education, supporting financially projects 24 or 36 months long. Now, most of the educational institutions will switch to digital education within one or two weeks, maybe a month, without any additional money from the EU or governments.

Then the question arises what to do with all that after the COVID-19 pandemic, as one of the CoI members noted:

> I'm very curious about the future education after the current pandemic. It has changed the relation to online communication for a lot of people. I can say from my experience that even being far away from the country where my relatives live, I helped my husband's niece with non-university level mathematics. It didn't happen in times before pandemic as I wasn't used to online learning/teaching where it is necessary to share notes/drawings. But it turned out there are a lot of already existing nice tools for that. I expect it happened to a lot of people and because of that, I'm interested in how it will affect consulting hours and (mathematics) support centres[9] after coming back to teaching in person. Whether it will be at least partially online or not as it's very easy, quick and convenient sometimes.

Another CoI member added a reflection concerning the student perception of on-campus education:

> There is a chance that after the campuses will open again and the students are back to the classrooms, they might appreciate the on-campus activities more than before the COVID-19 pandemic.

17.5. Conclusion and Future Development of the CoI

First of all, we can conclude that participation in the PLATINUM project was interesting for and contributed to professional development of all BUT CoI members. We encountered a lot of challenges and uncertainties. We were glad that we could always rely on support from more experienced colleagues from partner universities. We learned that any educational activity must take local conditions and circumstances into account. It was also inspiring and enriching to see how other partners deal with the challenges related to IBME in higher education. We noticed that it was not easy to find colleagues within our institutional environment who would be motivated to join us in the professional development. On the other hand, the form of our CoI allowed us to include members from different institutions who want to discuss and share experience with each other. Essential outcomes we see in the process of classroom observations and subsequent reflections. For most of us, it was an interesting experience to observe the classroom activity with a bird's eye view and get insight into the students' behaviour. This process always brought new questions and we learned how to use inquiry in teaching to influence students' engagement and inquiry in learning.

[9] For information about mathematics learning support see
www.sigma-network.ac.uk/about/what-is-mathematics-statistics-support/

We acknowledge that the COVID-19 pandemic made us reflect about ideas that we would never have thought about in relation to the classroom teaching. This is especially true for real-time online teaching, asynchronous learning, and remote learning support. We learned that digitisation of non-digitised subjects is time-consuming and additional resources are required to complete the process. Last but not least, using questionnaires as an indirect form of communication with students also proved helpful for development of inquiry-based learning and teaching activities. We perceive the experience that we collected during the PLATINUM project as having significant impact on our professional lives. We will never be the same as before.

We conclude this section by an outline of the potential future development of the BUT CoI. We will keep questioning ourselves how to do better in education. We can foresee development of further IBME-based teaching and learning activities, in particular activities supporting students' teamwork and mathematical modelling competency as well as applications relevant to concrete study programmes (for inspiration, see for example Chapter 12). That should be a long-time process due to the local conditions and constraints. We plan to continue collecting feedback from students.

However, what we perceive as most important for the future is keeping in touch and sharing experience within the CoI and beyond, with colleagues who are interested in professional development in mathematics teaching and learning. It is essential for us to be members of the professional community, the CoI. We were lucky to become a part of the PLATINUM CoI. We can foresee that relationships and collaboration across universities as well as with the MU CoI would make our BUT CoI more sustainable. We expect participation of the BUT CoI in more educational projects like PLATINUM because we like the taste of inquiry and we want to push our professional development further.

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