

The Hybrid Learning University: Insights, Challenges, and Lessons Learned from Best Practice at Brandenburg University of Technology

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Abstract—The following paper discusses the applied instruments of hybrid learning in the context of university education, especially video lectures, classroom response system and online-learning-diaries. We will demonstrate the application of hybrid learning instruments within different courses in combination with traditional learning elements at the Brandenburg University of Technology Cottbus-Senftenberg (BTU C-S). Using an embedded single case study design, we conducted an in-depth analysis of the applied instruments of hybrid learning including data from student's course evaluations, examination results, and log data from Moodle. The results show a varying picture. Video lectures match to the student's demand of flexibility, e.g. caused by the need of fulfilling a part time job. Classroom response systems are perceived as appropriate means of improving comprehension and repetition of course contents. Overall online-learning-diaries help intensify the learning experience and enhance student's self-reflection. In addition, the learning process itself and the combination of elements of traditional and the hybrid learning approach play a special role.

Index Terms—online-learning-diaries, university education, classroom response systems, video lectures, e-learning, success story, lectures on demand, blended learning

I. INTRODUCTION

The advent of multimedia applications in university learning is becoming more dynamic. The approach of hybrid learning allows a varied learning experience for the students. Particularly with regard to future learning, processed learning is of special importance and is a permanent fixture caused by the increased complex requirements [1].

For this reason, the foundation of the hybrid learning approach is especially situated in higher education. *Hybrid Learning* (or *Blended Learning*) combines technology-based and face-to-face learning methods [2].

The case of the Brandenburg University of Technology Cottbus-Senftenberg represents a success story. It demonstrates how certain instruments originating in the hybrid learning approach can be combined with traditional

teaching elements in different courses. In particular, we focus on video lectures, online-learning-diaries, and classroom response systems and monitored student experiences with these instruments during several semesters. Furthermore, lessons learned from application and implementation of the instruments are presented.

II. PURPOSE OF THE PAPER

The aim of this study is to analyze the experiences with instruments of hybrid learning. Students' and teachers' perspective are considered, as well as the main challenges dealing with hybrid learning. We decided to employ a qualitative approach with a single case study, which is appropriate for our purpose. Furthermore, we discuss weaknesses, strengths; opportunities and threats (SWOT) for the hybrid learning instruments applied in the case study. The central contribution of the paper consists of the lessons learned perspective from our case study, as well as the knowledge transfer, and sharing of experiences will enable readers to engage in hybrid learning methods and instruments.

III. CASE STUDY: "HYBRID LEARNING AT BRANDENBURG UNIVERSITY OF TECHNOLOGY"

A. Brandenburg University of Technology

The Brandenburg University of Technology Cottbus-Senftenberg (BTU C-S) has approximately 9,000 students (including 1,740 from abroad from more than 100 different countries). It is the second largest university and the only technical university of Brandenburg, Germany. The BTU C-S emerged as a new foundation from the merger of the Brandenburg University of Technology Cottbus and the Lausitz University located in Cottbus and Senftenberg. The consolidated university now also offers studies with application-related skills and the appropriate qualifications for Bachelor and Master. The teaching focus of the university is on the natural sciences, architecture and town planning, industrial engineering and business administration.

The Chair of Organization, Human Resource Management and General Management at the BTU C-S was taken over by Prof. Dr. Christiane Hipp in 2005. The Chair covers several areas of business administration

such as general management, personnel economics, organizational economics, and business ethics. Moreover, there are interdisciplinary courses, e.g., key skills for professional life.

Apart from our roles as teachers, we see ourselves as researchers who engage in a variety of topics. We benefit from our interdisciplinary know-how. Latest theoretical, empirical, and methodological research results are used and further developed to handle urgent current problems from different social, technical and economic fields. Current research and consulting projects deal with various mega-themes, including digital connectivity, societal transition processes, and new shapes of work. We think it is suitable to couple our research topics with our teaching activities and exploit the possibilities new media offers us. Thereby we can integrate up-to-date research topics vividly in our courses and foster the anchoring of knowledge. Above all, the collaboration between teacher and student plays a crucial role in this context [3], [4]. In order to meet this goal of ours, we implemented the concept of hybrid learning. Project headed, the Chair selected three instruments to implement: video lectures, a classroom response system and online-learning-diaries.

B. Videlectures

In 2011 our Chair first introduced video lectures. We started with one course in 2011; in 2015 the lectures of four courses were recorded and made available for students. The courses cover general management for first and second year students as well as courses for students near graduation such as business ethics, personnel economics, and strategic leadership and corporate governance.

Through the university's learning platform Moodle students are able to access the recorded lectures and watch them online anytime and anywhere where they have internet access. When students open a video lecture, they see the slides changing as the teacher proceeds, the video of the lecture and a navigational array. Additionally, students can use a search tool that enables them to search for specific terms within one video lecture. Naturally, students can pause the video while watching as well as go for- or backwards by using common navigational elements.

For recording the lectures a video camera and a laptop have to be set up. Video camera and laptop are connected. Usually, teachers are using a microphone that is synchronized with the laptop so that high quality sound is warranted. The video camera has to be operated by professional staff from the university multimedia department. Usually, the laptop is handled by one of our student assistants who ensure that the switching slides are synchronized with the video which appears online later. Post-processing of the recorded lectures includes adequate cutting, e.g., if there were interruptions during the lecture, and adapting it for the Moodle learning platform. Furthermore, headings of the slides and keywords enable students to search and navigate within the slides. Video lectures require equipment (video camera, microphones, laptop, and appropriate software) and additional staff.

C. Online-Learning-Diaries

Within the multidisciplinary module "Key skills for professional life" the students are coached in social, individual and methodological skills. Examination at the end of the semesters consists of a final presentation and the preparation and completion of an online-learning-diary (<http://www.oltb.de/>). It helps the students to summarize and comment on the topics of the seminar and triggers processes of self-reflection of their learning experience gained throughout the seminar.

Learning goals in the course are achieved by two levels. Firstly, students get a different learning experience through the direct deal with the issue through the record of their learning processes on the online platform. Thereby the learning experience is intensified. Secondly, the online-learning-diary is an excellent method for qualitative evaluation of the teachers. Individual learning protocols of the participants are received and offer a stimulus for teachers to improve their teaching style or optimize course materials. This is especially appropriate in an interdisciplinary environment.

Students are asked to deal with questions of varying themes that remain constant during the whole course, e.g. "My personal relationship to today's topic..." or "I can apply my new knowledge in these situations...". The course seeks to enhance interactive learning. With the possibility of interacting on the online platform, students can benefit from the learning experiences of their fellow students and exchange ideas. They can take a look at the most read posts, comments from other participants and may thus come into contact with students and teachers. Furthermore, they enter a platform similar to common social media-platforms in which they feel well.

Certain human resources are needed for the online-learning-diary. Developed by Prof. Dr. Joachim Ludwig of the University of Potsdam, the tool is online based and accessible via www.oltb.de. The appropriate course and individual sessions are created for each semester. These can be filled with either different or constant questions, which may differ depending on the learning objectives. At the end of the semester, the online-learning-diaries of all students are rated by transparent assessment criteria.

D. Classroom Response Systems

The Classroom Response System (CRS) was deployed in the course "General Management" in 2011 for the first time. This is a basic course for bachelor students. Approximately 150 students participate regularly in the quizzes conducted with the CRS every semester in winter.

The CRS consists of mobile and stationary components. Voting machines that are distributed among the students represent the mobile components. The static module is a laptop with specific software and a receiver which processes the signals transmitted by the mobile voting machines. The CRS software is compatible with MS Office PowerPoint and allows to easily integrate questions in an existing presentation.

In the mentioned course, the CRS was used for repetition and as a checkup of taught contents. Results of

the quiz are processed by the software and presented in form of bar charts, lists, or tables. They are immediately available after receiving the signals of the voting machines, which are used by the students. This helps the teacher to get an in-depth overview of the student's level of knowledge. Because of the purposeful use and in-depth view, it is possible to meet their needs. Furthermore, a simultaneous reflection of students' knowledge is possible. Another advantage is anonymous responding which can increase honest feedback about the level of knowledge of students. In addition to searching for mediated teaching content, the CRS can also encourage team skills, by making group tasks and quizzes. The use of this system, whether in individual or group context, provides an intensive preparation in the examination period.

Apart from checking the content of teaching and opinion makers, quizzes or tests can (not anonymous) be performed with the CRS. The diverse application possibilities open new options to teachers to organize their courses in a more interactive way. This promotes the participation of students and motivates them to cooperate at the same time. The results obtained by the CRS are later used by the analysis and reporting function. Subsequently, automatic data is processed and exported to Excel for students and teachers used for the before / after comparison. The CRS is well-established in our courses. The voting machines differ depending on the version, whether it's required to enter a number or short text. Entered numbers can be evaluated quickly and displayed by the software. In the case of qualitative answers (text editing) a manual rework is necessary. Thus, the mentioned time savings are not always possible. The technical (possibilities and use of CRS) introduction requires time. Through our experience, this is not a one-time expense, because of constantly changing participants (e.g. disease, absence etc.). However, the proper introduction of the CRS system is necessary before each event. Regarding the technical topic, another relevant aspect is the amount of time that is necessary to check up the battery level of each voting machine for the next survey. When not in use, the voting machines are turning in the standby mode after a period of 30-60 minutes. Thus, the associating of the results to a student or group is not possible anymore. This could lead to undesirable results in tests. Consequently, if the assignment is desired (test), the survey should be carried out in one piece.

E. Methodology

To answer our research propositions raised in section II we decided on a qualitative approach. Our study is settled at the Brandenburg University of Technology Cottbus-Senftenberg. We analyze the case of hybrid learning at the Chair of Organization, Human Resource Management, and General Management. Within this case we examine three instruments of hybrid learning that represent different units of analysis. This means that we look at a single institution but have different units of analysis. Therefore, an embedded single-case design seemed appropriate, illustrated on the figure below (Fig. 1), [5].

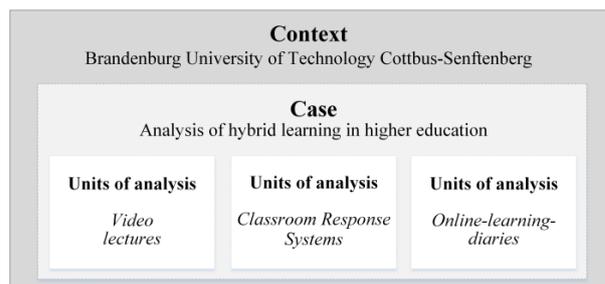


Figure 1. Case study approach based on Yin, 2013, p. 40

The data was gathered during a different period with a mixed sample, dependent on the offered course. For the analysis of the case, different evaluation approaches were used. As a common prerequisite the official feedback from students was taken. Depending on the unit of analysis, the objects were examined by additional methods. In examining the video lectures and the CRS, the average grades (GPAs) were considered additionally, as well as the log data from the learning platform Moodle.

The grades of the courses were studied, because they allow a before / after comparison. In this way, the grades of the subjects before and after the introduction of video lecture are confronted. Considering the online-learning-diaries they were used to allow a qualitative analysis. A summary of the methodological approach with the basic parameters is listed in the Table I. The data analysis method consists of clustering the evaluation feedback in main categories and analyzing important buzzwords, and the quantitative evaluation of the log data.

TABLE I. METHODS OF INVESTIGATION

Medium	Video lectures	Online-learning-diaries	CRS
Period	7 semesters	3 semesters	1 semester
Sample	n=203	n=89	n=150
Evaluation mode	1) university teaching evaluation 2) exam grades 3) log data from Moodle	1) online-learning-diaries 2) university teaching evaluation	1) university teaching evaluation 2) survey via CRS
Features of the course	General Management & Personnel Economics; more than 100 participants; lectures, seminars, and tutorials	Interdisciplinary course; seminar character; small numbers of participants	General Management & Personnel Economics; more than 100 participants; lectures, seminars, and tutorials Mainly business administration and industrial engineering; mass course

IV. RESULTS

The mixed approaches need to be considered differently because of the different context and instruments of hybrid learning. For this reason, the results are first considered independently to be finally summarized in a Strength-Weaknesses-Opportunities-Threats (SWOT) analysis.

A. Video Lectures

The analysis of the student's course evaluations shows that video lectures are perceived positively by the students in all four courses where videolectures are offered: *"The videolectures are awesome!"* (course evaluation: General Management). In fact, two buzzwords pop up when students evaluated the videolectures: flexibility and repetition. Students appreciate that they can choose between attending the lecture and pursuing other activities or fulfilling other duties. Some students engage in extracurricular activities, such as charity, others have to do part-time jobs to make a living. Furthermore, courses sometimes overlap so that students are forced to choose one they are going to attend. *"I like the video lectures! [As I myself could not attend the lecture because of overlapping courses]"* (course evaluation General Management). In case of illness, students can watch the video lecture again, so that there is no risk of missing something. Furthermore, they can watch the recorded lectures online as often as they want. For teachers, video lectures also enhance flexibility. For instance, video lectures can be used as a digital archive and as means of providing courses even if lecturers are unavailable for some reason. Especially in view of the high turnover of staff of a university that is very valuable (knowledge transfer). Additionally, video lectures are perceived as a valuable supplement of course materials. *"I like the variety of e-learning materials offered."* (course evaluation: General Management).

Apart from flexibility, students seem to use video lectures as means for preparation for upcoming lectures, exercises, and final exams. *"Video lectures help me understanding exercises."* (course evaluation: Personnel Economics). As obvious in Fig. 2, video lectures have a high traffic on the platform Moodle in the examination period (January and February).

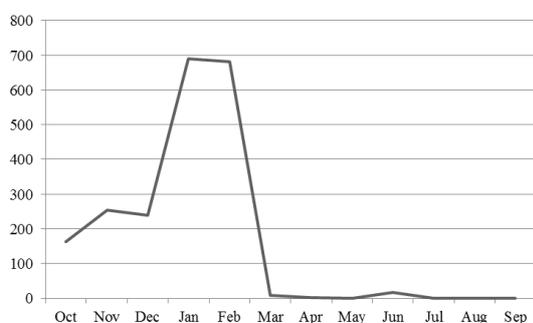


Figure 2. Log data from Moodle in winter semester 2014/2015

Here, however, it is striking that out of the nearly 700 calls in January and February on the platform Moodle, there were multiple calls from same students (157 unique

logins). It is noteworthy that a significant fraction of the students who call the video lectures have an immigrant background.

B. Online-Learning-Diaries

Since autumn 2013, the online-learning-diary was used as an exam method for the module, with consistently positive experience. After tentative parts in the beginning, there is a significant intensification in the duration of the semester. The students like to work with the online-learning-diaries, because it brings out a variety in their university learning environment:

"In previous studies, I noticed that the actual knowledge, which is accessible at any time, usually is quite low. Lot for exams is learned and little for the purpose itself" (male, study: Urban and Regional Planning)

"To again draw an overall conclusion of the seminar, I must say that I was pleasantly surprised by the seminar. It is an excellent complement to the rather theoretical everyday study." (male, study: Engineering)

"The must to keep a learning diary about any subject, was pretty costly in terms of time, but I was thus forced to confront myself with the topics again and internalize it." (female, study: Architecture)

In addition, students grapple with the diaries of their fellow students and benefit twice. They draw not only from their ideas and inspiration, but also formal (e.g. of the expression).

"We ran through the questions and got inspired by suggestions in the online diary and even got us some literature [to complete the task]" (female, study: Business Administration)

"[...] especially my written expression and formulation manner has improved little by little." (male, study: Architecture)

The majority of the participants brings their own ideas for the seminar and enriches the online contributions through personal learning situations or practical experience, which they have collected in connection with the issue or actual topic.

"The easiest way for the inclusion of information, however, I find by associating experiences or feelings with it" (male, study: Industrial Engineering)

Herewith particularly introverted students find their freedom and courage to participate in the seminar. Important in this context is an appropriate handling of information and suggestions of students, as well as the transparency of the evaluation of the learning diaries.

Therefore, an important success factor is the combination of the traditional approach with an online-based tool. Results that can be collected in online-learning-diaries are directly integrated into the teaching. Therefore, this combination is a valuable contribution to quality assurance of teaching.

Nevertheless, some students are overwhelmed with the freedom of their own learning experience. They ask for feedback to adjust their exam performance requirements,

although these almost do not exist (in addition to the formal requirements such as grammar and spelling). For this reason, there is a danger of the mere task fulfillment, making the goal of independent reflection give way to the permanent pressure.

C. Classroom Response Systems

When considering CRS two aspects were highlighted: the feedback from the students and a survey with CRS about the willingness / acceptance of the system. Course evaluations revealed that students mention the use of a classroom response system as a positive element of the course. Furthermore, they perceive working with a classroom response system as pleasant and enjoyable. It disposes a means to alter the students' role in a lecture from listen passively to engage them actively during a lecture.

“Working with the classroom response system@”;
“Repeat questions via using classroom response system@”
(both course evaluation: General Management).

In addition, students repeat course contents in an active manner so that before imparted knowledge is reinforced and “anchored”.

Looking at the willingness to continue to work with the CRS system, the technology is accepted (Fig. 3). A significant majority of students wish to continue to work with the CRS system (80% of respondents).

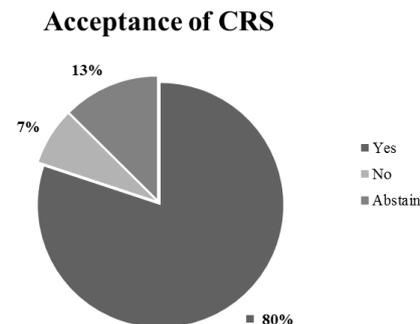


Figure 3. Willingness of students to work with CRS in further courses (survey via CRS in 2011, n=150)

D. General Outcomes

Considering the remarks of Kay & LeSage detailed literature analysis, many aspects observing our case can be confirmed. They include the following advantages as important factors for CRS: attendance, attention, anonymity and participation and engagement [6]. This can be applied to the elements of the hybrid learning because of the similarity. In addition, the learning benefits could be confirmed, with a particular focus on the interaction and quality of teaching which was confirmed through the feedback in our case. From our results, the following strengths and weaknesses of hybrid learning are presented.

TABLE II. SWOT-ANALYSIS

Medium	Video-lectures	Online-learning diaries	CRS
Strengths	- good complement / repetition -supplemented by e-test	-intense learning experience - learning record	- interaction - fun & acceptance
Weaknesses	- technical obstacles may occur	- desired feedback	- restriction on asking questions
Opportunities	- integration of diversity perspective - good in combination with other instruments	- generating ideas on various topics - improved teaching	- expansion through innovation (text entry, online based ...)
Threats	- isolation - students underestimate the lecture -not a substitute for presence	- information overload - dealing appropriately with comments of students - transparency of the valuation	-oversimplification of problems

Overall, the various models of the hybrid learning were preferred because of its flexibility. The main points are summarized according to their frequency of mention in the following Figure (Fig. 4).



Figure 4. Summary of the main nominations

If we observe the course general management, it becomes clear that not only aspects of unique units of

analysis are considered. Equally important is the structure of the lecture / tutorial and the varied methodology. Basically, students praise the general range of video lectures (44% of analyzed university teaching evaluation), which mainly is used as a repetition (17%) and for flexibility (13%) (e.g. learning from home).

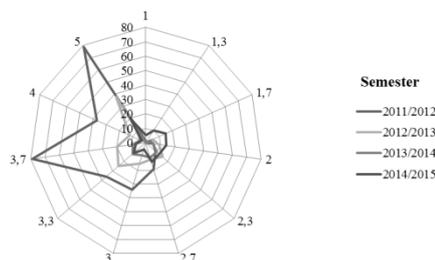


Figure 5. Average scores after the introduction of the hybrid learning

When considering the average grades is noticeable that, since the introduction of video lectures, they have become steadily better (see Fig. 5). The graph shows fewer peaks with respect to the grades.

Of course, this cannot be seen as the only influencing factor, since many factors affect the grades: environment, students' motivation, personal preparation, different teachers, personal supervision of the students etc. Nevertheless, it is important to note that the timing of the introduction represents a noticeable distinguishing point.

V. DISCUSSION

The results of the case study show varied results, both qualitatively and quantitatively.

One of the most important outcomes is the issue of students reflecting on their own learning experience. Thus, many positive effects emerge from the feedback. Firstly, they improve their learning methods by enhancing the competences for hybrid learning. This learning process is well complemented by the mixed methods of hybrid learning. Secondly, the positive reinforcement is a key success factor in learning [7]. Students increasingly interconnect positive feelings and experiences ("*loosening [of theory]*") with the learning experiences and bring them into their future course of studies. It disposes a method to alter the student's role in a lecture from listening passively to engage them actively during a lecture and by this leveraging learning process. Nevertheless, it should be noted that next to above-mentioned benefits, there are some disadvantages, especially regarding the CRS. The purchase price of CRS is round about 20,000 Euros, which is very expensive for a single receiver, the software and 300 mobile components. There are already some new (restricted) solutions which can replace CRS partially. Usually those applications are web-based and free available on the Internet (e.g. *Kahoot*).

With regard to diversity aspects, the hybrid learning can take a significant integrative part. Firstly, flexibility is granted to allow other tasks (e.g. care, parenting, and community involvement) some scope for development. Secondly, e.g. video lectures help strengthen the integration of students with migrant backgrounds, as they largely use the offer of video lectures. Regarding the situation in Germany (declining births, increase of intercultural background due to lack of experts) this aspect is of particular importance. With regard to the exam preparation, video lectures play a special role, as evidenced by traffic in the examination period.

In addition, the methods of the hybrid learning encourage pictorial learning. By presentation of the results via charts, or confrontation with own experiences images are continuously generated, which have a positive effect on the learning process [11]. In this way the sustainable learning is encouraged. Students develop self-criticism for their own process by reflecting their learning through various instruments. In particular, the learning diary provides sufficient space for this.

Still, there are some challenges which may occur: *technical challenges, teachers and students challenges*. As for the limitation of all online units, it must be said that it

may lead to equipment failure. Thus, the teachers are confronted with "technical stress", which may adversely affect the development of this particular course. Moreover, as confirmed by Kay & LeSage, challenges from dealing with the student's feedback may arise. The interaction should be designed in a way that an attached reaction of the teacher may result and doesn't bring him/her in any unwanted situation. In addition, the onset of CRS takes more time than "usual" learning methods, so that some of the teaching material cannot be considered in the fullness, as may be required by the plan.

The student challenges regarding Kay & LeSage are in the new method itself, because some of the students may find it difficult to vary their way of learning. Furthermore, it takes more effort to use the new methods [6]. In our analysis, similar effects were observed. Particularly with regard to the online-learning-diary, the beginnings were marked by uncertainty. Many students underestimate the effort of writing the diary. By change from the usual everyday university life, however, it is repeatedly reported by the students that they intensively deal with the matter, as they'd originally "planned" it. Here, the positive reinforcement plays a special role in learning motivation.

Also, video lectures and other methods of hybrid learning fit to today's student's lifestyle. Students carry instruments of digitization in their pockets, so that development of the university is indispensable. A broadened understanding of the course contents is likely but yet to be verified by empirical evidence. However, they make a significant contribution to preparing for the digitization.

A. Limitations and Future Research

The implications for our context cannot be transferred to other fields without any reflection and limitation.

There are several approaches that expand the possibilities of interaction with the students [8], [9], [11]. Particularly with regard to big mass courses, the hybrid learning yet provides a good approach to address the interactivity. Still, there are some limitations in our case study which should be considered.

Limited by our case study simply at our university, the comparability is critical. Universities are equipped differently (usually through the allocation of funds), so that a comparison is very difficult. First experiences with CRS or video lectures were collected, which are mostly based on the specific context of the university. A look at other European countries would be interesting, especially with regard to the various types of school systems.

Furthermore, the peculiarities of the multidisciplinary course in which online-learning-diaries were used cannot be transferred to all learning environments, as it is a seminar. For this reason it is also not clear whether the examination with the help of a learning diary would be bearable for several hundred students. In addition, learning with online-learning diary is mandatory, as it represents a significant part of the examination. Students are „forced“ to reflect and thus the voluntary nature of itself is excluded.

In addition, there are several approaches about the meaning of actual learning experience itself. Some

approaches are based on an individual consideration, while others rather consider learning as a process [10]. For this reason, a simple observation as in our case in this regard is not effective. Particularly with regard to individual differences, there are currently few studies and observations.

However, the overlapping effects of the hybrid learning should not be neglected in this context. Many students choose several modules of our Chair and carry the variety of the learning experience in their student life, and general learning behavior. For this reason, it is certainly difficult to determine whether the grade improvement is due to the pure video lecture or a fundamentally altered learning behavior by addressing the methods / or with another learning.

Mass courses, such as lectures, will continue to dominate the teaching at universities. Therefore, the challenge of combining methods for lectures appropriately will still be present. Feedback systems such as Classroom Response Systems or online-learning-diaries enrich the lectures with didactic meaningful components. There are expanded possibilities for the design follow, some already incurred as spin-offs of universities (e.g. *ArsNova* or *Kahoot!*). It is important to find a strategy that can wisely combine the methods and make them didactically valuable in use.

VI. CONCLUSION

This paper discussed the necessity of hybrid learning and it is based on the success story at the BTU Cottbus-Senftenberg, using an embedded single case study design. The chosen instruments (units of analysis) were considered more in detail: video lectures, online-learning-diaries and Classroom Respond System. The effect of the instruments has been considered explicit in different time periods and based on a different number of students. The predominantly positive effects relate to flexibility, variety in everyday university life, diversity of methods, analysis of the teaching material, as well to diversity aspects. The negative aspects are among other things "technical stress", students' effort while dealing with different methods (excessive demands) and oversimplification of problems. The results were observed from different perspectives, which were compiled in a SWOT analysis, limited by the single case study in Cottbus and future research aspects. The combination of traditional instruments with the elements of the hybrid learning is essential as the personal supervision is still an integral part in the student feedback.

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research. In her dissertation, Ms. Gliem is analyzing the dynamics that underlie interactions between service provider and service customer. By this, she is seeking to improve the customer-provider-relationship.



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