

RESEARCH ARTICLE

Early internationalization of students in a German medical school in the former German Democratic Republic

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ABSTRACT

The growing influence and importance of internationalization in higher education, especially in medical education, inspired anatomists at Columbia University New York, USA and at the Martin Luther University Halle-Wittenberg, Germany, to start a novel international preclinical collaboration project. As part of the anatomy dissection course a group of volunteer medical students from Halle dissected selected areas of the human body with the help of an English, illustrated, iPad-run dissection script (*American Dissector*). Meanwhile the rest of the students worked with a traditional German text-based dissector. Additionally, participating German students were matched with US students, with whom they connected via video-conferencing and discussed subjects like differences between their health care systems, structure and content of the anatomy course and the differences in their medical education systems. Questionnaires were sent for feedback and checklists confirmed dissection findings. Results indicated that the *American Dissector* was successfully shared internationally. The majority (62%) found it easier to find structures using the *American Dissector* compared to the standard dissector and also 62% needed the atlas two times less when using the *American Dissector*. Furthermore, students enjoyed their interaction with their international peers and the vast majority (77%) wished there were more interactions like this in the medical curriculum.

This publication describes an approach to embed internationalization in the preclinical medical curriculum based in the gross anatomy course in a German Medical school, located in East Germany. Considering its history as a former German Democratic Republic faculty this is a meaningful step toward globalization of medical education in this part of Germany.

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1. Introduction

The Department of Anatomy at the Martin Luther University (MLU) Halle-Wittenberg has a long history. In the year 1502 the Medical Faculty was one of the founding faculties of the MLU. Famous anatomists (e.g. Philipp Friedrich Theodor Meckel, Wilhelm Roux and Johann Friedrich Meckel the Younger,) worked in the Institute of Anatomy. In these times collaborations with foreign universities and research institutes were numerous. However, in the GDR (German Democratic Republic) era the international exchange (at least with non-socialistic countries) was completely disrupted on the university directorate level. After the German reunification former and novel international partnerships were

established. Nowadays, the MLU is the biggest university in the state of Saxony-Anhalt and cooperates with more than 65 Universities from around the world in study programs and joint research projects.

The gross anatomy course at the Medical Faculty of the MLU starts in the third term (second year) and lasts from October until the end of January. Every year about 260 medical students are divided up into groups of six people to work on one body donor. Students work with a dissection script for instruction, provided on electronic tablets in the laboratory. Gross Anatomy dissection manuals are used in courses worldwide. Traditionally, the gross anatomy dissection manuals are hard copies or bound volumes that need to be adapted to suit specific school curricula. Most of them are unpublished or published as textbooks (e.g. Tillmann and Schünke, 1993). Most are meant to be used in conjunction with Gross Anatomy atlases that provide drawings of completed dissections. Dr. Bernd, one of the contributors to this article, has

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written an interactive digital Gross Anatomy dissection manual in collaboration with local medical students. The advantage of a digital book is that it can be customized for a particular course, easily updated and does not need yearly re-purchasing as do hard copies. The Columbia dissection manual is also unique because it contains concise instructions with step-by-step images of real dissections in conjunction with simple drawings from a free-use version of Gray's Anatomy (Gray, 2000). In addition, there is a glossary linking all bold terms to a thorough description of that item and interactive quizzes that students use following a laboratory session to evaluate their performance. Columbia's medical and dental students have been using this dissection manual for the past seven years in the Gross Anatomy course. As a result, student dissections and grades have improved, and it is very popular among students, as indicated by student evaluations. The dissection manual has garnered national attention (Bellini, 2013).

Internationalization and international exchange are important topics for the academic formation at times of globalization and international mobility. The impact of internationalization in medical education is influenced by the globalization of health care delivery, government pressures, improved channels of communication and outcomes-based education (Harden, 2006). Regarding a three-dimensional model – based on the student, the teacher, and the curriculum – internationalization should not only involve student mobility but rather should be the development of a transnational medical education (Harden, 2006).

As part of our dissection courses we started an international collaboration between the Department of Pathology and Cell Biology, Columbia University New York, USA and the Department of Anatomy and Cell Biology of the MLU Halle-Wittenberg, Germany. The purpose of this project was to merge two aspects of internationalization into one: the exchange of different dissecting experiences as a consequence of this transatlantic collaboration, and the matching of German and US American peers. The Department of Anatomy and Cell Biology of the MLU is the first German institutions to introduce such an international project. Considering its history as a former GDR Faculty this is a meaningful step not only for the development of medical education but also reflects the progressive nature of this project. The aim of this project was to combine the traditional concept of the dissection course with the modern idea of internationalizing medical education – at a school that has a history of isolation for several decades in the past.

2. Methods

2.1. The pilot study

The first steps of the project started in October 2014. At that time, second year medical students (n=80, 5 students per table) of the Martin Luther University Halle-Wittenberg, Germany were divided in two groups (A and B). Group A used the English, illustrated, iPad-run dissection script (*Dissector*) written by Dr. P. Bernd, for the thorax dissection, while Group B worked with a traditional German text-only script. Later Group A used the German paper dissector for the abdomen dissection and Group B used the American *Dissector*.

Photos and checklists at fixed time points were taken and sent for evaluation to the P&S Anatomy Faculty in New York. At the end of the term questionnaires were sent to Group A and B. The acquired data were analyzed with the help of the services at the Biostatistics Department at the Mailman School of Public Health. First year American students (n=21) enrolled in the Clinical Anatomy course volunteered to videoconferences at least one or more times with Group A and B to discuss anatomy related topics, compare findings, but also other medical related topics such as differences

in health insurances, medical school systems and more. The date of the videoconferences and their content were not predefined or controlled. Subsequently, questionnaires were sent to all groups to evaluate the videoconferences.

The positive results of the questionnaires and the evaluations led to the continuation of the project in 2015. Nevertheless, we decided not to incorporate the results of the pilot study in the project described below, because of the different dissection areas, the changing number of participating students and the lack of a predefined structure during the videoconferences.

2.2. The project

One year after the pilot study the student exchange and the use of the American *Dissector* was performed and evaluated again. In the first part of the project, a group of volunteer medical students from Halle dissected two regions using the American *Dissector*. In the second part of the study German students were matched with small groups of volunteer US medical students, with whom they discussed subjects including the iPad *Dissector*, compared structure and content of the anatomy courses, their health care systems, and their medical school systems.

2.3. Recruitment

The program started in October 2015 – preceded by the above described pilot study in 2014. It was introduced to third term students during one of the first anatomy lectures. Interested students were asked to sign up with their name, email address, and number of dissection table. The participation was voluntarily and without any restriction. However, only group registration of one entire dissection table (6–7 students) was allowed. The students had to be fluent in English. Selection bias cannot be excluded since these were volunteer students. 140 German medical students (22 tables) participated in the study. One student of each table was appointed as the contact person for the US partners. At Columbia University 13 volunteer students were matched randomly with the 22 German tables, so that nine US students were asked to video conference with two groups (tables) and four US students with one group (table). All Columbia students were using the iPad *Dissector*.

2.4. Dissector

The German students worked with the American *Dissector* for two dissection areas - Abdomen and Head/Neck. They started with the Abdomen *Dissector* in November 2015 for 12 dissection days. The second part was the head/neck region and the *Dissector* was used starting in January 2016 for 12 days. The students were given detailed instructions on how to use the American *Dissector* and additionally received a vocabulary list. Both German groups, American *Dissector* and German standard script, dissected the same structures on every day of the dissection. Both dissection scripts were provided as pdf-files on tablets in the laboratory. The German students spend on average eight hours per week in the laboratory, whereas the American students spent three hours per week dissecting.

2.5. Checklists

After each dissection day, tutors confirmed whether every structure listed in the respective section had been found by all student groups (both, student groups enrolled in the study and the other students) and marked it on checklists. Every checklist contained eight columns: table number, time dissection started, time dissection ended, Group 0 or 1 (Group 0 working with the German dissection script and Group 1 working with the American *Dissector*),

structure to be identified, found (identified Yes/No), only partially found (because of an anatomical anomaly, dissection not completed, or item partially destroyed by the students) and not found (because of an anatomical anomaly, prior surgery/removal, dissection not completed, or item destroyed by the students). Checklists were transferred to Excel, followed by the statistical evaluation by statisticians of the Columbia University, NY. Analyses were done separately for a particular region. For each table, a score was calculated. Descriptive/summary statistics (n, mean, sd, median, interquartile range, min, max) were provided for each group separately. A two sample t tests and Wilcoxon rank sum tests were performed to calculate the differences between the groups.

2.6. Live small group video conference sessions

In the second part of the study students contacted their small group partners via email. Small group video conferences started after the dissection of the abdomen was completed. Students organized and scheduled these sessions on their own. They had to perform at least one session within a certain time period (from November until February). They could also decide whether only the contact person or the whole group would take part in the session. Students received a discussion guide as a common theme for their conversation. The guide included subjects such as the anatomy course, lectures, the education and healthcare system, and also *Dissector* related questions. The guide should serve as a suggestion for their conversation. The procedure and content of their videoconferences have not been controlled or documented.

2.7. Evaluation

At the end of the project all participating students were asked to fill out a two-part online questionnaire using Qualtrics®. Both parts contained multiple choice questions, but also open ended questions. The first part of the questionnaire (with questions in regard to the video sessions) had to be filled out by both, US and German students. The second part (with questions regarding the use of the *Dissector* on tablets versus the standard German dissection script) had to be filled out only by the German students. Completing the questionnaire was voluntary. No statistical evaluation of the questionnaires was performed. Data were summarized using Excel®.

2.8. Ethical approval

The iPad *Dissector* exchange part was approved under IRB protocol number AAAO2409 and the student exchange part was approved under IRB protocol number AAAO3715 at Columbia University, New York, NY, USA. Furthermore, waivers from the Ethics Commission at the Medical Faculty, Martin Luther University Halle-Wittenberg, Germany were obtained.

3. Results

3.1. Cohort

A total of 140 German students participated in the study (Table 1). The gender ratio within the group was 100 female (whole semester: 158) and 40 male (whole cohort: 79) students. The success rate in the head/neck exam was evaluated. While 87.1 % of the participants passed their head/neck exam, 92.6 % of the students who did not take part in the study (n = 135; female students n = 85, male students n = 50) passed the head/neck exam.

Table 1
Participants and results of the head/neck exam

	Participants (%)	Mean age (years)	Pass head/neck exam (%)
Total number of students (n = 140)	100.0	21.5	87.1
Female students (n = 100)	71.4	21.0	86
Male students (n = 40)	28.6	22.7	90

3.2. The picture-based *Dissector* vs. a standard text-based dissection script

The evaluation of the checklists revealed that the students working with the *Dissector* found more anatomical structures both, in the designated time and over the whole time period of 16 days. Spending a total of 16 days in the laboratory with the two different dissectors the students working with the American *Dissector* found more structures on nine days, found the same on four days and found less on three days compared to the students working with the German dissector. The questionnaire was filled out by 70 students (response rate of 50%). The evaluation of the general preference (Fig. 1) showed that 36% liked the iPad (American *Dissector*) more than the standard German dissector, 58% liked both dissectors equally and 7% liked the iPad (American *Dissector*) less than the standard German dissector.

The students were asked how easily they found the structures using the iPad (American *Dissector*) versus the standard German dissection script (Fig. 2). The majority (62%) found it easier to find the structures using the American *Dissector*, 34% could not detect a difference between the American and the German dissection script and only 4% found had difficulties to find the structures using the American *Dissector*.

Furthermore, the students were asked how much time they spent using an anatomical atlas during dissection periods with the American *Dissector* versus dissection periods with the German dissection script (data not shown). Most of the students (62%) needed the atlas two times less when they used the American *Dissector*.

For 59% of the students there was no difference in spending time in the laboratory when they used the iPad (American *Dissector*) vs. the German dissector (Fig. 3), 23% spent on average at least 30 minutes more in the laboratory using the iPad (American *Dissector*) vs. the standard German dissector, 9% spent on average at least one hour more in the laboratory using the iPad (American *Dissector*). Further 9% spent on average at least 30 min less in the laboratory using the iPad (American *Dissector*) and 1% spent on average at least one hour less in the laboratory using the iPad (American *Dissector*).

3.3. The small group video sessions between American and German peers

A total of 60 German and American students took part in this part of the survey. Concerning the overall experience with the sessions, 42% of the participating students liked it ("It was exactly what I expected"), 22% liked it very much ("It exceeded my expectations). For 22% of the participating students the Skype sessions did not meet their expectations (Fig. 4).

In terms of continuation of the program 44% of the students requested that programs like this should be part of the medical curriculum (data not shown). Solely 12% were against a continuation of the program in the future. This trend could also be detected in the result of the question whether the students wished there were more interactions like this in the medical curriculum (data not shown). The vast majority (77%) agreed with this idea. Finally, the students were asked whether they wanted to be contacted again

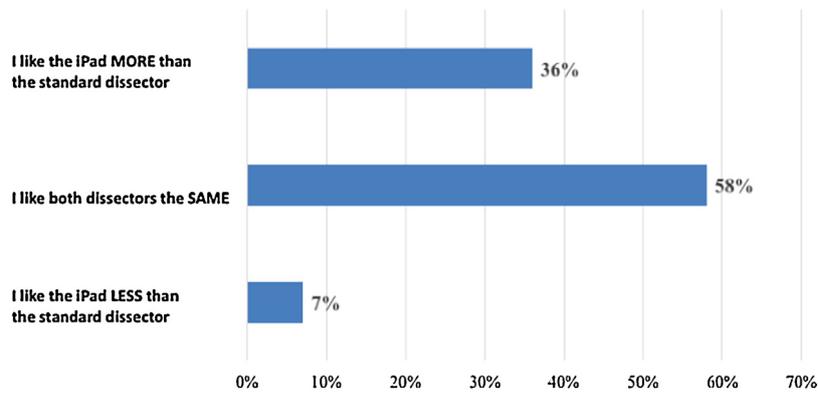


Fig. 1. Self-reported general preference for either the iPad (*American Dissector*) or the standard German dissector; n = 70.

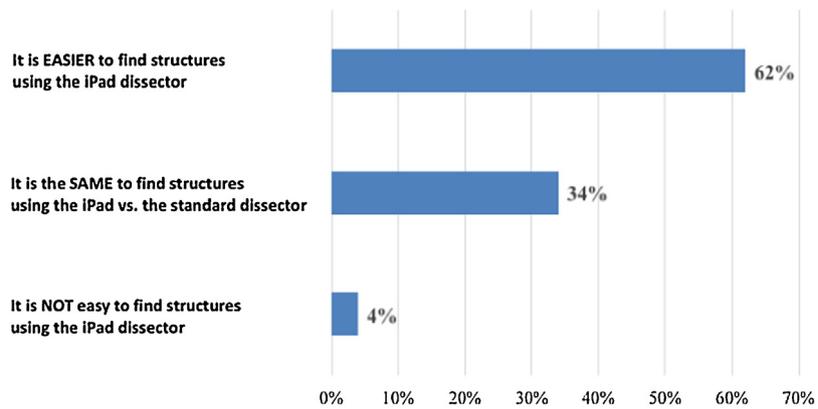


Fig. 2. Self-reported opinion how easy it was for the students to find the structures with the iPad (*American Dissector*) compared to the standard German dissector; n = 70.

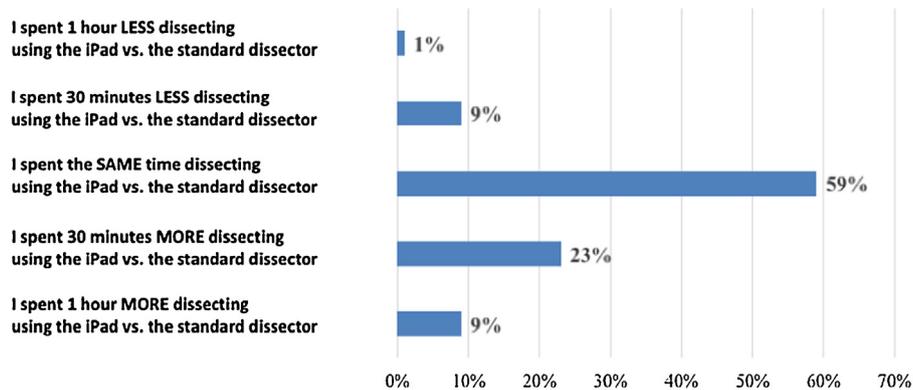


Fig. 3. Self-reported time spent in the laboratory when using the iPad (*American Dissector*) or the standard German dissector; n = 70.

or remain in contact with their peers (Fig. 5A). At least 44% found it likely to be contacted again in the future, 35% were undecided and 20% found it unlikely. In terms of staying in contact with their peers (Fig. 5B) 48% were undecided whether they would stay in contact with their peers, 17% found it likely and 35% found it unlikely to stay in contact with their peers.

4. Discussion

This study reports from one of a few German programs that introduces an international collaboration project starting early in the curriculum between two medical schools (Tillmanns et al., 2007). It is the first one that collaborates on teaching material in the anatomy course. Projects that aim to support internationalization and collaboration can enhance competitiveness, retention of fac-

ulty, federal funding opportunities, advancements in science and education. The present study investigated the acceptance of a foreign teaching tool in form of the *American Dissector* and the attempt to establish and reinforce early international medical collaboration between students of two universities. Of importance, intercultural exchange was established between partners of different historical and cultural background. According to the results of the questionnaire the majority of the participating students would appreciate to have more programs like this in their curriculum. It seemed to be a well-accepted and desired addition to the established syllabus. The rise in globalization has influenced the development of higher education for a long time. For traditional universities internationalization it not only means to enhance research and knowledge capacity, but also to increase cultural understanding (Altbach and Knight, 2007). Internationalization in higher education can include

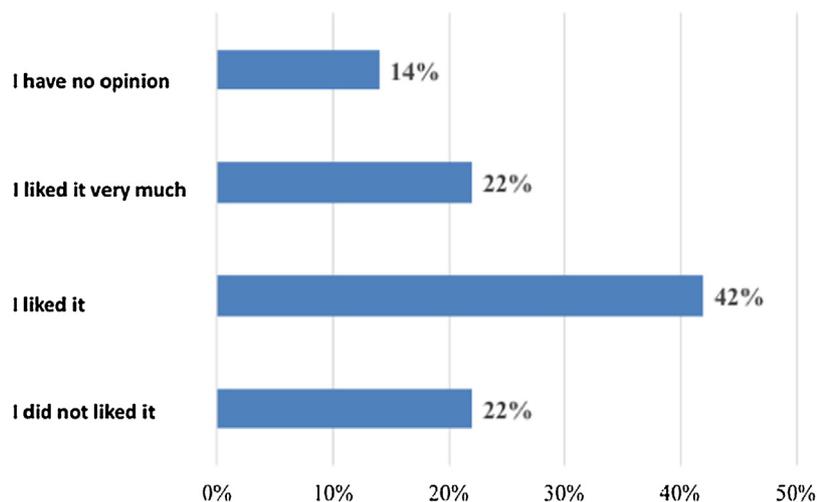


Fig. 4. Overall experience with the Skype sessions between US and German peers; n = 60.

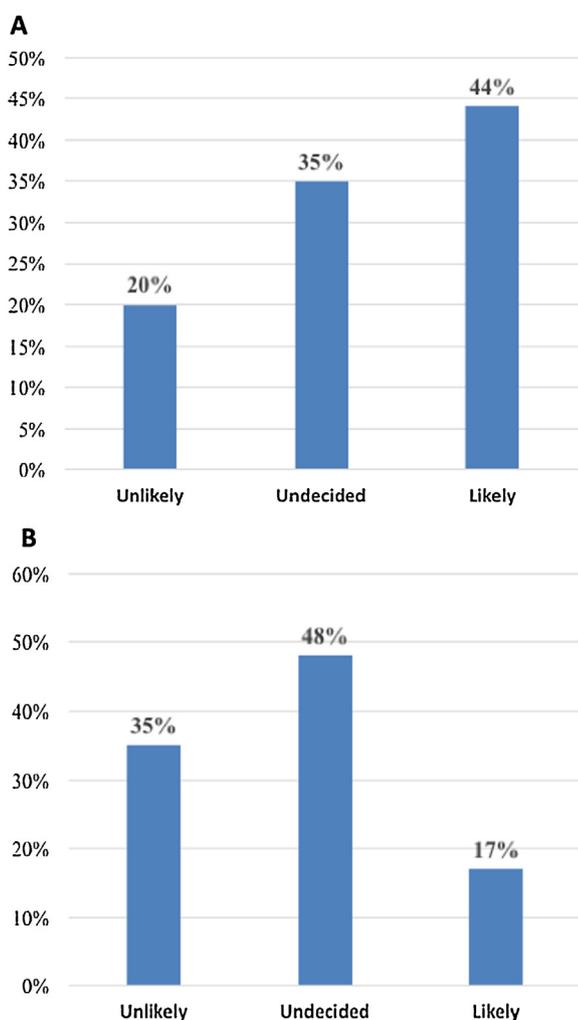


Fig. 5. Self-reported wish to be contacted (A) or to stay in contact (B) with their small group session peers; n = 60.

student mobility. A growing number of medical students are willing to go abroad during their studies or gain some international experience (Heinrich et al., 2013). Although physicians are more and more confronted with growing challenges caused by globalization i.e., greater variety of diseases, culturally diverse patient popula-

tion, language barriers and social inequities between and within countries (Stutz et al., 2015), no sufficient changes to the existing medical school curricula exist (Knipper et al., 2015). Therefore, it is important to start introducing internationalization as early as possible in the curriculum.

For this project it was challenging to adapt the American *Dissector* to the German script so that both groups were dissecting the same topics on a given day. The advantage was that anatomy is a subject which is universally taught in medical schools around the world and it remains a solid part of medical curricula worldwide. Nevertheless, dissecting with two different scripts at the same time, respectively two different ways of approaching structures, demanded a high motivation and preparation of both students and staff. Another challenge was the difference in speed of the dissections and the time limits given by set hours of dissection. The German students spend on average eight hours per week in the laboratory, whereas the US students spent three hours per week dissecting. Both groups of students reported it was difficult to get in contact with each other, as well as keeping the contact, i.e., because of the different schedules, difference in time zones, varying levels of motivation and the limited time due to their demanding schedules. Another challenge was the proportion of American to German students. A one-on-one session between one American student and one German student could have probably worked out better and was strongly demanded by the students. They also asked for more structure rather than a self-directed schedule, such as set dates for the video interviews and pre-formulated questions for discussion. This is a common challenge in intercultural exchange activities to strike a balance between giving them a fixed schedule and letting them organize their meetings on their own (Ambrose et al., 2017).

A relatively high percentage of students (22%) did not appreciate the small group conferences. The lack of a set structure could be responsible for this – especially given that the majority of students are very young (under 20 years of age). Videoconferencing, such as Skype, appears to be a good medium for international exchange between two foreign student groups. However, it is difficult to keep track of the individual conversations and to organize the interviews respectively to impart the contacts between the students. We have improved this in the subsequent years, i.e. by working on a paper or presentation (data in preparation).

The students using the American *Dissector* spent more time in the laboratory than the others. Possible reasons could have been the complexity and richness of detail of the American *Dissector*, the intensity of the dissection regions, the foreign language, but also the motivation and preparation of the participating students. The

content of the American *Dissector* was also new to the majority of the staff working in the laboratory, which led to instructional difficulties. One student group quit the program in the first week and another group considered it just before the beginning of the head and neck dissection part. There was no real preference between the two scripts according to the students. This project also revealed the advantages and disadvantages of E-learning and digital teaching and learning aids. Both is gaining more and more importance in medical curricula (Kuhn et al., 2017). The use of the American *Dissector* required modern techniques and equipment, technical understanding, personal resources and additional work hours, for example to ensure the compatibility of the American *Dissector* on the tablets used in the laboratory. The use of digital supplies and E-learning requires a balanced technical standardization between the collaborating faculties. The realization of such an international program demands efforts, including staff that is willing to invest additional time and faculty support on both financial and technical counts (Ruiz et al., 2006). It was also shown, that actively taking part in the internationalization process can be challenging concerning increasing faculty workload, curricular adaption processes and ensuring quality teaching and support for students (Altbach and Knight, 2007).

In the pilot study 2014 the feedback of the students was better than in 2015. One explanation could be the different dissection regions (2014 thorax and abdomen; 2015 abdomen and head/neck) with diverse complexities and demands. The implementation of this project revealed the challenges that medical education, especially anatomy is facing – i.e., budget constraints, reduced resources and lack of expert anatomy faculty (Fischer and Pabst, 2003). For those reasons there will be no one-to-one adoption of the American *Dissector* by the dissection course in Halle (Saale). However, the cooperation between the two schools will continue and the low resource demanding virtual small group and planned in person student exchanges will be expanded.

5. Limitations

The cohort could not be randomized because it had to be assured that the participating German students were able to speak English at an advanced level. Thus, selection bias cannot be excluded since these were volunteer students. We did not measure or determine the anatomical prior knowledge before the start of the study. This influencing factor could also have affected the result of the daily dissection outcome of the individual groups.

The goal of the second survey about the general feedback, which was sent to both American and German students, was the confirmation of the feasibility of the program and the student's subjective perception of the program. Since answering the questionnaire was anonymous we cannot separate between the German and American view.

6. Conclusion

The objective of this project – the formation of a transatlantic collaboration between a former GDR university with an American Ivy League school was successful. We aimed to raise students' awareness for the importance of being interconnected and informed about different approaches to medical education and exchange of knowledge and experiences was accomplished. Fur-

thermore, the foundation of an international collaboration between two medical schools has been initiated, resulting in a successful continuation of the program in the subsequent years. Currently this project is annually performed with nine countries. Additionally, a basic sciences summer internship one year after the video conferences was implemented (Wu et al., 2019).

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Ethical statement

The iPad *Dissector* exchange part was approved under IRB protocol number AAAO2409 and the student exchange part was approved under IRB protocol number AAAO3715 at Columbia University, New York, NY, USA. Furthermore, waivers from the Ethics Commission at the Medical Faculty, Martin Luther University Halle-Wittenberg, Germany were obtained.

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