IMPROVING INTEGRATION IN UNIVERSITIES FROM A STEM STUDENTS' PERSPECTIVE

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ABSTRACT

In recent years diversity, equity, and inclusion have been broadly discussed in terms of the impact they can have on society. Being in a diverse environment during one's studying period has been shown to enhance several skills, including teamwork and communication. Nevertheless, the current Higher Education system does not always provide a discrimination-free setting which enables such cognitive growth. Hence, it is crucial to promote the integration of diverse groups in STEM education and foster such integration with concrete actions.

This paper aims to display European STEM students' perspectives on integration methods within universities, with a focus on cultural and gender diversity. The students' points of view were collected through a survey on diversity and multiple sessions designed with different formats. These sessions were held in BEST Symposia on Education (BSEs), which are live events organized by the Board of European Students of Technology (BEST).

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This research aims at lowering socio-cultural barriers that exist in universities and influences students' lives by proposing a set of applicable actions. Initially, this study discusses the identified barriers and how they affect the learning experience. Then, it suggests actions that can be taken to overcome such barriers, tailoring them for the different stakeholders involved. This paper draws its conclusions based on the opinions of STEM students and it can provide insights and actions that professors, universities' management, students, and associations involved in Higher Education can adopt to create an inclusive and discrimination-free environment.

1 INTRODUCTION

In recent decades, globalisation has been profoundly changing the structure of our communities and our lives. Nowadays, our society has been evolving into a globally interconnected world, increasing people's mobility and the possibility to interact with individuals from different backgrounds. In this changing scenario, today's graduates are expected to be able to work in highly diverse teams across different cultures [1, 2]. Among the new skills that need to be developed, we find creativity, collaboration, and interpersonal dynamics. Studies have shown that students who experience a diverse environment develop adaptability, cross-cultural communication skills, and conflict-resolution skills that ultimately lead to improving productivity and performance [3-5]. Hence, Higher Education should adapt itself effectively and efficiently in order to provide society with a suitable workforce.

Nevertheless, in Science, Technology, Engineering, and Mathematics (STEM) a discrimination-free and inclusive environment has not been reached yet. When dealing with diversity, and the lack of it, the main focus is raised on attracting talents who belong to underrepresented groups, be it for cultural differences, disabilities, gender, or sexual orientation [6]. However, confining the problem to the recruitment area is not solving the issue; the necessary step forward to be made is inclusion. A university that cares about inclusion aims to ensure that the needs of diverse groups are properly addressed. By doing that, universities create an environment that allows students from various backgrounds to feel welcome and comfortable, such that they want to stay enrolled [7].

This paper explores the opinions of STEM students regarding diversity, cultural barriers, and integration techniques through the analysis of reports written by the Board of European Students of Technology (BEST). With a network of 93 universities in 34 countries, BEST is a non-political, non-governmental, and non-profit voluntary students association committed to supporting students' self-development in an international environment. To achieve this goal, BEST offers a set of different events that are intended to bring universities, companies, and students closer.

2 METHODOLOGY AND MATERIALS

The Educational Involvement Department of BEST is a dedicated body of the organisation that aims at connecting STEM students with contemporary educational needs on engineering education. Through the work of this department, BEST strives to gather, analyse, and disseminate the students' ideas on what can be improved in their universities, study programmes, and curricula and share it with relevant stakeholders. The department work's is structured around Educational Involvement Programmes, which are biennial focused research on a broad topic. In the biennium September 2018 - September 2020 BEST committed to gather information, analyse and study the topic of Diversity in STEM higher education by collecting students' opinions through a survey and live events. The goal of such a research programme

was to collect qualitative input from European STEM students from diverse backgrounds and disseminate their opinion to relevant stakeholders.

This paper bases its conclusion from three live events which happened within the context of the Educational Involvement Programme on Diversity: the BEST Symposia on Education (BSEs) in Aveiro (2019, "Light, camera, educACTION!"), Athens (2019, "Plato's Symposium Vol II: Diversity"), and Skopje (2019, "STEMbox: Open your eyes and see the diversity"). BSEs are live events that allow students to actively contribute to the discussion on Higher Education thanks to carefully designed sessions. These sessions are created beforehand by the Educational Involvement Department of BEST through the work of the facilitators/content team of the event. Each one of these events has three to four facilitators whose role is to direct the discussion in such a way as to ensure inclusivity in the event. During these sessions, various facilitation methods are applied such as Brainstorming, World Cafe, Sharing Session, SWOT analysis. All information collected from these sessions is processed to create a final report of the event on which this paper is based. In order to have representative outcomes, in each of these events more than 20 STEM students from different countries are selected per event, based on gender, academic qualifications and origin to ensure diversity. In addition, this study takes into consideration the results obtained through a survey on Diversity in STEM Education conducted by BEST between October 2018 and April 2019. The survey was disseminated among the universities where a BEST local group is located and collected more than 400 anonymous answers. The topic of diversity was first addressed at diversity in general and then deepened into three categories: cultural diversity, gender diversity and disabilities. Within the scope of this survey, the general introduction and the first two dedicated sections are taken into consideration.

3 ACTIONS TO IMPROVE INTEGRATION IN UNIVERSITIES

This section discusses barriers that prevent universities from offering an inclusive learning experience with respect to cultural and gender diversity. For both types of diversity, first the identified barriers are introduced; then, tailored actions are presented for each of the three key stakeholders: universities, students, and NGOs.

3.1 Cultural Diversity

The existence of various ethnic or cultural groups in a society is defined as cultural diversity. Our lives are constantly impacted by cultural diversity, be it in the professional, academic or private domain. Its consequences can be different for us or our society depending on where it occurs [8]. The existence of multiculturality is of high importance in an educational environment in today's world [9]. This statement was further emphasized by the survey conducted by BEST where 42.39% of the interviewed students strongly agreed and 37.31% partially agreed that multiculturality is an important factor in the quality of higher education.

3.1.1 Universities

During BSE Athens, participants concluded that ethnic segregation, unequal evaluation, language barrier, and lack of curiosity are the main cultural problems that are faced by students in universities. The participants suggested the following solutions for each of the above-mentioned issues [8]:

- Segregation: forming culturally diverse teams for projects was discussed as a solution to the problem of segregation as it would enable international students to interact and collaborate with local students in an academic environment and promote learning. Another solution can be a "buddy" or mentoring programme, which is already used in some European universities. Having a local student assigned to an international student can help them obtain practical help but also learn more about the country's culture and habits. A successful mentoring system is also beneficial in helping international students integrate smoothly into the academic system by getting guidance on the areas to pay attention to. In addition, it can be used to obtain personal help in case of need and should have both local and international students involved as mentors to make the international students feel more comfortable to connect and share.
- Unequal evaluation: participants observed that equal evaluation for local and international students is not yet always achieved. Universities should work on providing a unique evaluation metric. On this topic, it was suggested that a more regulated and strict system for all universities would make things more transparent in terms of evaluation.
- Language barrier: it can be diminished by encouraging professors to take English courses for better communication, and enhancing the quality of the English courses offered while also focusing on non-technical vocabulary.
- Lack of curiosity: it can be increased by effective promotion of international opportunities and benefits like scholarships and internship programs.

Furthermore, participants highlighted that a successful collaboration between universities and NGOs is essential in ensuring a balance in cultural diversity. NGOs and student organizations organize extra-curricular activities that can develop students outside the classroom. However, these are not always supported by universities. Among various issues in the cooperation, it was reported that universities need a physical space or an office where information regarding clubs and organizations is available since the university websites do not contain this information [8].

Promoting international exchanges is also seen as a way to increase the interaction of students from different cultures and help them tolerate different cultures [8]. However, there are different problems associated with mobility programs, the solutions to which were discussed in the BSE in Skopje [10]. According to students, one of the biggest problems is that Erasmus exchange programs can be expensive; a scholarship or support from either the government or university can help mitigate

this problem and make exchange opportunities accessible for everyone. In addition the majority of the students that filled the survey conducted by BEST agree that cultural diversity, which can be enhanced by such mobility programmes, is vital to the improvement of quality in STEM higher education, as shown in Fig.1.
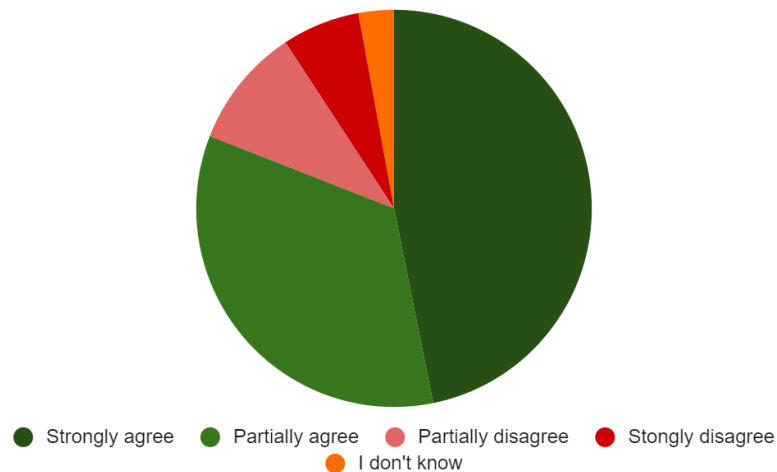

Fig 1: Students' responses on the statement: "Multiculturality is an important factor regarding the quality of higher education.". These data come from the survey on diversity conducted by BEST during 2018 - 2019.

3.1.2 Students

Working with students from different cultures can be challenging and disagreement on working methods was seen as a common problem. A solution to this problem was reaching a consensus on working methods by the students at the beginning of projects or courses to avoid problems and confusion during it. Furthermore, the implementation of a mentorship system as the one proposed in 3.1.1, can be jointly executed through an initiative by students in a university. Most universities have student representatives in the form of a council, a link to the senate, etc. However, these representatives mostly help with matters regarding education and are not that involved when it comes to cultural diversity. It was discussed that the transparency regarding the work of these representatives should be improved by sending periodic reports or emails to the students. Additionally, these student representatives and their organizations should actively participate in matters concerning cultural diversity, possibly with a representative for international students [8].

3.1.3 NGOs

One of the outcomes from the BSE in Skopje was that diversity and integration should be high priorities for NGOs and they should always be welcome to accept all kinds of students by organizing integration activities [10]. Evidently, there is a

significant need for cultural education in order to bridge the gap in mentality. Events like cultural evenings done by student associations were identified to help in contributing towards this gap in mentality by making students aware of different cultures by letting students talk about their country, traditions, food, etc. NGOs and student organizations along with universities should also organize competitions where international and local students can collaborate and interact together, also on a personal level [8].

3.2 Gender Diversity

Gender equality refers to the equal enjoyment of their rights, responsibilities, and opportunities and it implies that the interests, needs, and priorities of each gender are respected. Despite the effort in reducing the gap carried out in recent years, studies show how women in STEM education and profession are still underrepresented [11]. This perception is aligned with students' perspective about gender representation in STEM studies: only at one out of the seventeen universities represented in the BSE Aveiro, the gender percentage was perceived as 50-50 [12]. Considering the outcomes of the survey on diversity conducted by BEST, we have comparable results: as seen in Fig. 2 and Fig. 3, the respondents perceive that in their faculty the majority of people are male, both when taking into consideration the whole department and the teaching body only. In further discussions on this topic, participants stressed how having a bigger variety of perspectives, among which different genders, leads to better problem-solving skills.

Ratio of Males/Females in STEM Education

● less than 50% male　　● more than 50% male　　● 50% male - 50% female
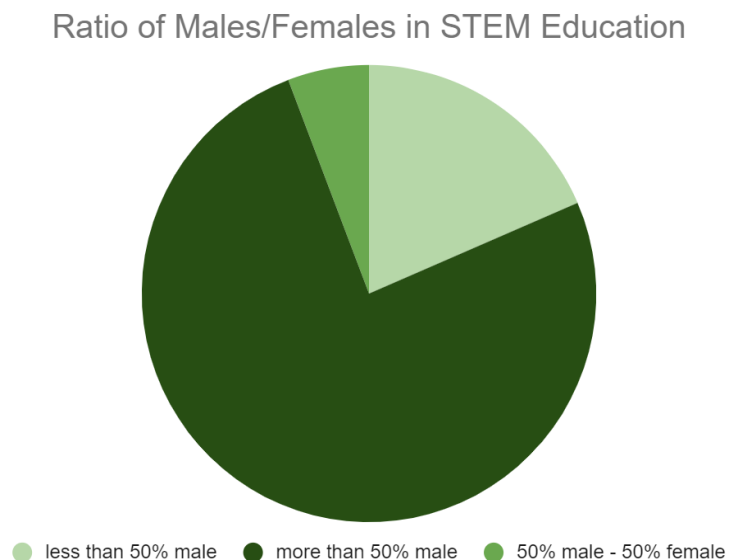
Figure 2: Students' responses when asked about the ratio of males to females in their faculty (students, professors, administrative personnel and management). These data come from the survey on diversity conducted by BEST during 2018 - 2019.

Ratio of Male/Female Professors in STEM Education

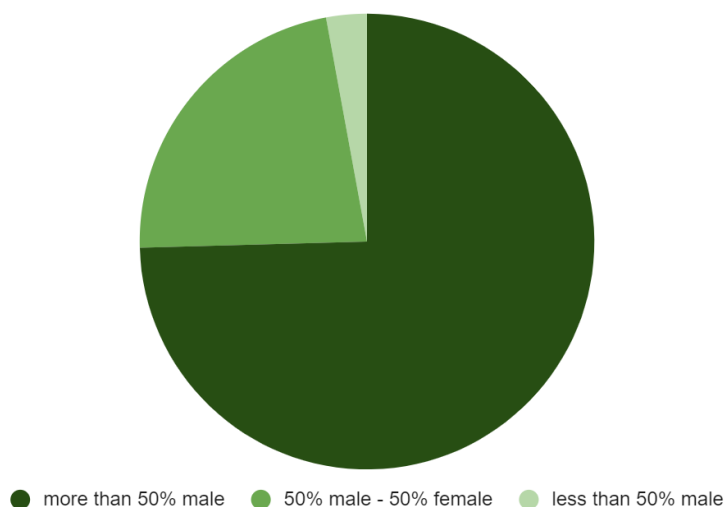● more than 50% male   ● 50% male - 50% female   ● less than 50% male

Figure 3: Students' responses when asked on the ratio of male to female professors in their faculty. These data come from the survey on diversity conducted by BEST during 2018 - 2019.

3.2.1 Universities

Given the key role universities have in shaping our society, it is important that the European Higher Education system creates an environment in which gender diversity and inclusivity can properly be achieved. In addition to the importance of reaching such a healthy environment for an optimal learning experience, students consider universities that minimize gender inequality as more meritocratic.

In various sessions of the aforementioned BSE, many problems linkable to gender diversity were brought up. After brainstorming and clustering them, participants agreed on this set of barriers as being the most important one to be tackled: lack of opportunities, lack of action, sexism and harassment, discrimination, and stereotypes. In order to tackle such barriers, participants created an action plan to support gender equality in Higher Education and foster a diverse environment. The most relevant actions included to fight the different problems are:

- Lack of equal opportunities: build proper universities policies to evaluate impartial behaviour from the teaching staff, ensure that the sponsored job-advertisements are gender-neutral.
- Lack of action: create a feedback system to identify problems earlier, establish procedures to denounce faultily behaviours, increase training opportunities on diversity and gender equality.
- Sexism and harassment: take concrete actions against offenders, organize training sessions on the matter, raise awareness through public channels and events.
- Discrimination and stereotypes: anonymous feedback and evaluation systems, establish policies to control discriminatory behaviours.

In addition, participants pointed out the disparity in gender employment at universities. When asked about women's participation in STEM studies, students observed that, while in teaching and administration the percentage of females is about the same as males, management is still a predominantly male role. This matches industry standards [11] and contributes to the problem of the lack of female role models in STEM professions. To counteract this barrier, universities should advertise and promote success stories of women in STEM fields, organize events with such well-known figures and actively use social media to share women's voice equally as their male peers.

3.2.2 Students

Among various stakeholders, students themselves can have an active role in fighting gender inequalities. Complementary to the actions presented in the previous section, during the BSE Aveiro [12], participants proposed a set of actions that students themselves should carry out to promote gender equality. These measures aim at lowering the identified barriers: lack of action, discrimination, stereotypes, and biases.

The actions are focused on students' role within the Higher Education system and are deemed practicable by BSE participants.

- Lack of action: reports incidents of any gender mistreatment or behaviour; actively use and request university support when a problem is identified.
- Discrimination: increase student awareness on gender equality issues via discussion and support groups;
- Stereotypes: establish a culture of equality by example, promote mix-gender activities.
- Biases: raise awareness of the potential impact of unconscious biases, speak-up when biased or discriminatory behaviour is witnessed.

3.2.3 NGOs

The positive impact that NGOs can have in Gender Diversity is tackled in BSE Athens [8] and BSE Aveiro [12]. Students mentioned NGOs as positive actors in promoting gender equality as often such organizations organize competitions and events which encourage gender diversity. Participants in BSE Aveiro believe that students organizations can help to reduce gender inequality by raising awareness on the topic during their activities, provide a discrimination-free support group, incentive mixed-gender group work, and address issues with university management.

Although they do provide students with opportunities for extra-curricular activities that formal education does not offer, some universities tend not to support organizations mainly due to financial and bureaucratic reasons. Often NGOs perceive a low support from local institution when it comes to office and logistics need, bureaucracy in dealing with university regulation and organization of activities, and opportunities of promotion within the campuses.

4 CONCLUSION

Diversity and inclusion have been broadly discussed in a European Higher Education setting; on this matter, a relevant voice to be heard is students'. As highlighted in this paper, STEM students can provide numerous suggestions to enhance diversities in their studies and thus to tackle the problem of integration of diverse groups. BSEs provide students with a platform to share their opinions, discuss problems and propose solutions to the raised issues. Therefore, the suggestions gain more value due to the experiential perspective the students give them. STEM students have made it evident that they would have a more meaningful learning experience if they were given the chance to work in a more diverse and inclusive group. Thus, with this paper, we see an opportunity for young people to set a new trend of inclusiveness and cooperation under the guidance of experienced people and experts in their field of studies.

The series of actions we showed to tackle cultural and gender diversity were selected as students considered them to have a high impact on the quality of their education and the fairness of the university system. According to students' perspective, the solutions offered above are practical and achievable, and therefore it is now on the various stakeholders to take initiative and work together to promote integration and break the barriers of diversity. Mostly, those actions require the stakeholders to get a better understanding of the benefits that gender and cultural diversity can bring in an educational environment, through various methods. Future work can vary from validation studies on the effectiveness of the proposed solutions to further research on methods to improve integration and sense of belonging.

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