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A Systematic Review of Project Allocation Methods in Undergraduate Transnational Engineering Education

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Abstract: The final year design project is one of the most important components of any undergraduate engineering program. Fair and efficient project allocation procedures can be vital in ensuring a great student experience and exceptional learning out of these projects, which then could contribute in shaping students' future prospects. In this paper, we review a wide range of project allocation strategies used in various universities at undergraduate levels. We then focus on the project allocations in transnational education (TNE) contexts, which inherit additional allocation challenges. We highlight these challenges and provide recommendations to solve them. We present and compare project allocation strategies adopted at two of the largest TNE programs in China. We also present the factors that influence the project allocations, particularly regarding TNE provisions. Finally, we describe the challenges associated with the project allocations in the TNE scenario, along with proposing some feasible solutions to address these challenges.

Keywords: final year project; undergraduate engineering program; transnational education; project allocations; matching under preferences

1. Introduction

Final year undergraduate projects are generally a key part of any science and engineering degree program. It can be considered the most substantial project undertaken by an undergraduate during their degree, and it largely provides the first opportunity for students to work independently on a project for a year. Throughout the project, students are required to apply the scientific knowledge they gained during their studies, as well as learn new science [1]. Student learning outcomes from final year projects can primarily be divided into two categories: knowledge of science and general skills [2]. For example, knowledge of science refers to the design of an experimental or computational study, as well as problem-solving skills, whereas time management, creative thinking and communicating results can be considered general skills. Final year projects are generally resource-intensive, where the student needs strong academic supervision throughout the project's duration. Achieving a passing grade for the final year project is critical; for example, if a student is unsuccessful to attain a passing grade, they may not even be awarded an accredited degree.

Allocation of projects to students, assessment procedures, access to resources, support and supervision and general management of projects can be considered key influential parameters that govern students learning experiences during the final year project [3]. For example, if students were allocated to projects or supervisors arbitrarily, without considering students preferences or without

considering project supervisors' research interests, this will generally result in a poor or unsatisfactory relationship between the student and the supervisor [4]. Project allocation is a resource allocation problem with certain constraints, where to enhance the student learning experience and satisfaction, it is also essential to consider students preferences for projects.

With the prospect of the Teaching Excellence Framework (TEF) on the horizon for universities in the United Kingdom, actions to improve the National Student Survey (NSS) scores have become a vital exercise for many academics. NSS measures student satisfaction from a range of aspects, where it is mainly aimed at final year undergraduate students. The final year project is a vital element of the final year undergraduate programme and it can significantly impact the NSS scores. Consequently, allocating final year undergraduate students to the correct projects is essential for improving their learning experience, engagement and eventually to enhance their satisfaction [5,6].

University academics, particularly in the field of science and engineering, have shown great interest regarding the practices currently used to allocate final year undergraduate students to projects [4,7,8]. The main reason behind that interest is the extreme importance of final year projects and their contribution towards the award of degrees to the students. The project allocations are virtually the starting point of the year-long projects, and therefore it is vital to allocate the projects in a way that is acceptable to both the students and the staff members for a pleasant and enriching experience. As mentioned in Anson and Smith [8], in the case the project does not match student's interest, they may lose the motivation to work on the project, which could result in a low-quality project outcome, and in some cases, poor student-staff relationships. However, the previous works are limited in terms of the generalisation of the findings for specific scenarios like transnational education (TNE) programs.

Allocation of final year undergraduates to projects is a key challenge for TNE programmes. The global growth of TNE is rapidly increasing and becoming an integral part of the internationalisation strategy of most universities [9,10]. Transnational education is generally challenging for science and engineering programmes, particularly to sustain high standards with all the other constraints, and to meet the requirements of accreditation organisations [11]. This becomes substantial when students enter into their final year of study. For example, allocation of final year projects to students should be conducted considering all the constraints associated with TNE. Simultaneously, it is critical to ensure that student learning and engagement during the project is sustained at the highest level and should demonstrate the effectiveness of the selected project allocation mechanism.

With the increasing number of constraints, universities have to rethink the techniques used to allocate final year projects to students while further improving student learning and student satisfaction. This becomes a significant challenge with the increasing number of students in science and engineering TNE programmes. Simultaneously, universities are subjected to increased scrutiny to maintain high standards from accreditation bodies, as well as through the potential TEF. There are numerous final year project allocation techniques published in the literature, where the primary objective of this paper is to review such techniques with the focus of identifying the effectiveness of those techniques with respect to the challenges of TNE. The main objective of this review is to not only provide the available options regarding the allocation of projects, but also present the applicability of some of the working scenarios in TNE programs by comparing and contrasting the pros and cons of the current major practices. At the same time, we present some solutions that are efficient and scalable with the growing size of the TNE programs.

2. Project Allocation Methods

Undergraduate final year projects offer opportunities for students to undertake independent project work and to develop subject-specific and generic skills. It also provides an opportunity for staff to work closely with the student and strengthen individual students' skills, which are not visible from a standard course assessment. However, the success of achieving some of these underlined objectives also depends on the project allocation scheme used at the beginning. Various types of project allocation techniques are used in engineering and science streams: project selection by students based on project

titles provided by staff, project allocation based on the preferences of both (or negotiation between) students and lecturers, project based on student's own proposal, etc. Each allocation technique has potential strengths and weaknesses, where a student's choice of project is influenced by their desire to work with a particular academic staff member or desire for a particular project area [7].

Project allocation is a resource allocation problem where the key constraint for any programme is to ensure that the project workload among the staff are distributed evenly while matching projects to student's demands. Doing this for a large number of students is a challenge, where the final year projects are allocated manually.

The manual processing sequence is very time consuming and inconvenient to all parties involved. For instance, a student may have to manually search for a good number of project titles to find the relevant projects and then prioritise them in a form that is difficult to modify after submission. It is also troublesome for supervisors to keep track of the final year project proposals that are submitted and make changes later on. It is also very stressful and tedious for the committee members to manually assign final year projects to students one by one [12,13]. Therefore, most of the universities with a larger number of students these days apply some form of computer algorithms that perform the allocations based on certain inputs and constraints [14,15]. In this section, we will discuss a few of the most common and popular student project allocation (SPA) methods.

2.1. Project Allocation Based on the Preferences of Both (or Negotiation between) Students and Lecturers

This is one of the most common SPA methods, where both students and supervisors have their own preferences. Typically, the available projects are advertised to the students, and having browsed through the descriptions, each student (either explicitly or implicitly) forms a preference list over the projects that they find acceptable. Supervisors may also have preferences over the students and/or the projects that they offer. Manlove and O'Malley studied the problems of allocating projects, where both students and lecturers have preferences over projects, and both projects and lecturers have capacities [16]. They proposed different algorithms and tried to find a more stable allocation process but could not strongly propose one single method without having some approximation. Later, Iwama et al. built upon the algorithms presented by Manlove et al. and proposed an improved stability index for SPA [17]. Moussa and El-Atta also studied the algorithms of Manlove and O'Malley [16] and presented a new SPA model in which the lecturers have preference lists over pairs (student, project), and the students have preference lists over projects [18]. Furthermore, Kazakov [13] mentioned several complexities after analysing two different approaches applied in two consecutive academic sessions, where both the students and supervisors have preferences over projects. Kazakov identified several problems of those methods and proposed a new method having three phases, which saved time for both students and supervisors and reduced the number of randomly allocated projects [13]. Other than making a preferred list of project titles, in some cases, students contact supervisors directly and express their interest in listed projects. A project is allocated to a student if both parties, that is, the student and the supervisor, agreed and confirmed on the same project number. The concept of first come, first served is applied and the process is usually conducted via email. Gallagher et al. suggested that with this system, there is still the problem of "popular" titles, where a large number of students are attracted to a small number of projects [19].

2.2. Project Selection by Students Based on Project Titles

This is another popular SPA system, where students choose their projects by themselves based on the project titles provided by the supervisors. Many higher educational institutions worldwide have adopted this system to allocate final year projects to students [3,7,20,21]. Cheung et al. [12] described the method the Department of Civil Engineering of National University of Singapore follows to allocate the projects to final year students. They proposed an algorithm, which is intended to find an optimal allocation scheme that best matches a student's preference to the student's eligibility for the corresponding project, subject to the constraints in the student's ranking, their prioritised project

selections and available project spaces. This allocation scheme ensures that everyone gets a project that best matches the student's personal preference with their ranking.

Harland et al. [7] carried out a case study to compare the factors that influence students' choice of project in the two allocation systems, namely choice of specific title and choice of subject area followed by negotiation, and to determine whether different factors were relevant. This case study demonstrated that there is no significant difference in the factors affecting student project choices between allocation by project title and allocation by subject area followed by individual negotiation. However, the staff were generally much more enthusiastic about allocation by subject area than by title. Open comments indicated that they were able to match students' interests, and to some extent abilities, more closely to the research projects they had available. However, SPA by project titles has benefits, such as it saves the supervisors' time spent on negotiations with students regarding any project. It also ensures that the higher-ranked students get their desired projects to work with.

2.3. Project Selection by Students Based on Supervisors and/or Project Category

Obtaining a satisfying allocation for both students and supervisors by negotiation and/or preference list is a challenging task, especially when the number of available supervisors is small and their popularities are highly diverse. Serrano et al. [22] stated that no allocation system can guarantee that every student gets their first choice when the number of students is significantly greater than the number of available supervisors. They proposed a novel method based on a ranked list of supervisors, as well as categories provided to student, where a category corresponds to a general research area. A student's satisfaction may therefore correspond to getting a project either with a highly ranked supervisor and/or in a highly ranked category. Although they claimed to have an improved level of satisfaction of students and academics, this method could be more time consuming as students have to negotiate the project title with their preferred supervisor or in their preferred area of research even after the allocation. A similar problem will occur in the method proposed by Salami and Mammam [4], where they proposed assigning supervisors to students rather than assigning project titles by using their algorithm. According to them, the advantages of this method is that the projects are not required to be available at the time of allocation, and students and supervisors can discuss their project ideas/topics with each other after the allocation.

2.4. Project Allocation Based on Students' Own Proposals

Another common and popular way of SPA is a "student-led" allocation system. In this system, students design their own project and approach a member of staff to be their supervisor. Students contact supervisors directly via e-mail or in person, and it is up to that member of staff to agree to supervise the student or refer them to someone else. The topic and content of the project is established entirely between the supervisor and student. Thus, a minimum of admin staff support is needed until after the topic and supervisor have been identified [23]. There are some positive aspects of running a student-led model as Harland et al. stated that projects suggested/proposed by students promote active student participation [7]. Chang [24] argues that in this method, independent students need inspiration and occasional guidance rather than full supervision such that students approaching the end of their degrees become autonomous and independent learners. Despite having these advantages, the student-led model also raises a number of issues for the undergraduate cohort as a whole. First, most undergraduates find choosing a research topic difficult as undergraduate students rarely have deep knowledge of any particular area in order to identify a research rationale. Students often identify a very general topic area for research, and usually produce research questions that are too broad to be tenable [23]. In Hidi and Renninger's terms [25], their interest in research needs some substantial external support, and therefore, supervisors need to spend time working on the feasibility of the project, even though students work fairly autonomously on their dissertations. This can end up with the supervisor suggesting a very different topic afterward negotiations, where students can feel disenfranchised as their ideas are set aside and they are channelled into a project for which they have

less interest, enthusiasm and ownership [23]. Volkema [26] also suggested that asking students to create their own projects from scratch presents a few difficulties and takes considerable time. Analysis from the literature and informal feedback from those involved suggests that the student-led system is unsatisfactory for the majority of staff and students.

2.5. Other Project Allocation Techniques

Besides the methods described above, many higher education institutes follow other kinds of SPA methods. For instance, algorithms presented in References [20,21,27] provide students with two options, where students can either choose one project from the pool of supervisors' proposed titles or they can propose their own title. Also, many schools/departments, especially outside the U.K., prefer final year projects to be done in groups [3,21]. This can significantly reduce the load for supervisors and make the allocation process a lot easier. However, this method is mainly adopted so that students can learn teamwork and develop communication and leadership skills through their final year project. Allowing group projects can also solve one critical problem of SPA, as described in Section 2.1. As no allocation system can guarantee students first choice when the number of students is significantly higher than the number of projects, it becomes common that more than one student is attracted to the same project. Anwar et al. [28] suggested an alternative strategy, where individual students make a ranked selection of projects as usual, but form groups of up to three members from the individuals, who preferred to get the same project.

3. Project Allocations in TNE Provision through a Project Database

In this section, we will focus on some of the allocation methods deployed by two of the most successful TNE programs in China. One of the programmes is the joint degree program between the University of Glasgow, U.K., and the University of Electronic Science and Technology of China (UESTC), China, namely Glasgow College UESTC (GC-UESTC); and the other program is between Queen Mary University of London (QMUL), U.K., and Beijing University of Posts & Telecommunications (BUPT), China, namely the QMUL-BUPT joint program. The student population in GC-UESTC is 540, while it is 625 in QMUL-BUPT.

3.1. Student–Staff Agreement before Project Allocation: An Offline Method

This approach is followed by the QMUL-BUPT Joint Programme. Each year, all staff members propose 10–11 projects. In June, before the project starts in the new academic year, a final year project workshop to year 3 students is held in Beijing. This is for participating supervisors to introduce themselves and their project ideas to the potential project students. All supervisors' introduction files are also published on QM+, a local portal.

At the beginning of the academic year, supervisors first outline the proposed project ideas, which include a brief description of the project, four tasks, three measurable outcomes, required skills and difficulty level indicator. The project outlines from QMUL supervisors are reviewed by a panel made up of BUPT academic staff and vice versa. Once approved, the project outlines are released to students on QM+. All projects are released at the same time and students can do a search and filter by various options.

The students are given about 3 weeks to study the proposals. Students then contact supervisors to express their interest in a particular project. Supervisors evaluate the competency and appropriateness of the student for the project. This could be done through email exchanges or formal interviews. Once the supervisor and the student mutually agree to work together, the project is removed from the database and a contract is signed between supervisor and student regarding the project allocation. This approach is based on a first come, first served principle. After the allocation deadline, a match between unallocated students and projects is made by the coordinator taking required skills, application area, etc., into account as much as possible.

As can be seen, this allocation method works well since the students have the opportunity of getting their first-choice projects and the staff have the option of selecting students who they consider suitable for the project. Therefore, both students and staff have some sort of control in the project allocations. However, at the same time, the process is time consuming for students and particularly so for staff. For a large student cohort, it may not be feasible for the staff to respond and evaluate all the interested candidates. At the same time, the students have to spend time convincing the staff to assign them the project without the guarantee of a project allocation. Some weak students get neglected in this process as they tend to avoid contacting supervisors due to a lack of confidence in their abilities.

3.2. Project Assignment through a Matching Algorithm: An Online Method

In this section, we discuss the project allocation methodology used by GC-UESTC. Before we proceed further, we provide a brief background about the program model. At GC-UESTC, there are 540 students admitted each year in three degree programs, Electronics and Electrical Engineering, Communication Engineering and Microelectronics System Engineering. After completing all the degree requirements, the students receive two degrees, one from the University of Glasgow and the other from UESTC. Approximately half of the courses are taught by local UESTC staff, while the remaining half of the courses are taught by University of Glasgow staff who fly in from Glasgow to Chengdu for teaching. The block-based teaching model is used where one month's worth of teaching is condensed into one week of teaching. Since Glasgow academics work on a fly in, fly out model, they have limited interaction with the students compared to UESTC staff.

For the project allocations, all staff members from both universities upload their projects on a specifically designed project database. Students are provided 3–4 weeks to study the projects. During this time, they have the option of contacting the supervisors for queries and clarifications. Later, the project database is opened for students to make their selections in the order of their preferences. Students rank their project preferences separately for University of Glasgow staff and UESTC staff. Once all the student preferences are registered, the preference list is used as an input to a matching under preferences algorithm [29,30]. This algorithm is specially designed to match the preferences under a set of conditions. These conditions include the minimum and maximum number of projects a staff member can supervise, the number of students who could work on a project, the target average load of a staff member, the split in load between University of Glasgow and UESTC staff supervision, etc. The objective function of the algorithm could take several forms. Some of the most used objective functions could be maximising the number of students with project allocations matching their highest preferences or minimising the number of students with project allocation matching their lowest preferences.

This algorithm ensures that all the students are assigned the projects according to their top preferences. In some scenarios, the algorithm could fail to converge for some of the students meaning the algorithm is unable to allocate a project to a student from any of the student preferences. The manual selection process can be deployed for the remaining students as the number of unassigned students is small (less than 2%).

This process is extremely efficient in terms of saving time for both staff and students, while ensuring students' preferences are matched to their allocations. The solution also appears transparent and fair to all the staff and student, eliminating student discontentment and staff competitiveness. However, both students/staff are not guaranteed to have the supervisor/student of their own choice. We propose to have a small percentage of pre-allocations in place to address this issue to give some scale of control to staff and students in the project allocations.

3.3. Comparison of the Presented Approaches

In this section, we compare both of methods presented above, which are currently being practiced in two of the largest TNE programs in China. We have presented our findings in the form of a table, Table 1, where we have compared the two allocation processes based on several features.

Table 1. Comparison of the allocation methods in two TNE programs.

Feature \ Institute	QMUL-BUPT	GC-UESTC
Time efficiency	Time consuming due to the staff–student negotiation phase	Time efficient due to the absence of negotiations
Workload efficiency	More workload for staff and students	Little workload on staff and students
Scalability	Less scalable for a large number	Extremely scalable for any number of staff and students
Student control	More student control as there is a possibility of getting their top preferred project	A little less control as the students have a higher possibility of getting one of their lesser preferred projects
Staff control	More staff control due to their role in the selections	No staff control

4. Factors that Affect the Project Allocations in TNE Programs

In this section, we discuss the factors that influence the project allocations. Our main focus is the TNE provision and we reflect on how some factors critically play their roles in the project allocations.

4.1. Student Size

Student size is one of the basic factors that impact the project allocations. With few students to be assigned projects, the allocation problem complexity is generally quite low. However, as the student number grows, the problem complexity grows as well. Meeting the expectations of all the students while taking their interests and supervisors' loads into account, the project allocations become challenging. Rasul et al. [31] stated that the coordination and supervision of final year projects is challenging, especially where large numbers of students work independently with large numbers of supervisors. Limited resources make it difficult for project course coordinators to provide adequate staff development for supervisors. Monitoring the work of so many supervisors is also a difficult task for the project coordinator. Moreover, Johnson and Johnson [32] indicates that the capabilities of students to manage individual project work need to be taught explicitly by the mentor; it is not sufficient just to ask a student to work to manage a project. And according to Rasul et al. [31], supervisors supervising five or more different undergraduate projects at one time have little time to “train” students, which is a very common issue for programmes with a large number of students.

Most of the TNE programs are running with large student populations, especially the TNE programs involving China, which at times exceed 500 in student size. With such large numbers, it may not always be possible to perform the project allocations fairly and efficiently and this leads to the necessity of exploring new approaches in project allocations. In response to increasing student numbers, Healey et al. [33] suggested that group project work could be used to maintain the quality of coordination and supervision. This would also give them experience with teamwork, which is common in many jobs and in some conceptions of research in science and engineering. Another benefit of working in teams is that, where the group functions effectively, better quality work is often obtained than where students work individually. A few case studies are provided in Healey et al. [33] showing how the average mark for the *Issues in Environmental Geography* module based on a group projects was consistently 3–5 percentage points higher than the average for other individual final-year modules in geography.

4.2. Project Proposal Presentation

It is important to consider how the project proposals are presented to the students. In some scenarios, especially during the 1990s, the staff used to upload their projects through some student

portals or on their personal websites [13], while in some cases, the list of offered projects used to be displayed at their office doors or notice boards. Students could discuss projects with supervisors and then sign a form to confirm a written agreement. This is also the case at some universities these days where the total student number is not that high. In some institutions, the allocation of students to the supervisor is done by the head of the academic department or the project coordinator. Students then meet their supervisors and the project topics are given to the students to work on or the students themselves submit a list of topics to the supervisors and the supervisors choose their preferred one [34]. However, this approach is characterised by two or more problems, namely biasedness and conflict of interest, as noted by Aderanti et al. [34]. To accommodate a large student population, universities have developed their own project databases where all the staff upload their proposals to the project allocation interface and all proposals are available for the student to view and make their selections. As discussed earlier, several models have been proposed by education researchers for this selection process, which can satisfy both students and supervisors, as well as the project coordinator. For example, Abraham et al. [29] suggested a model where the students supply preference lists over projects that were offered by lecturers and each lecturer supplies a preference list over students who show interest in one or more of their projects. Li Pan et al. developed a model using goal programming [35], where they tried to maximise the number of assigned projects, satisfying as much as possible both students' and the department's preferences. Dye [36] and Kazakov [13] proposed models using a "stable marriage" algorithm to match members from two different lists (e.g., men and women, students and projects, etc.) according to the preferences expressed by each of the lists' members. Harper et al. [37] and Srinivasan and Rachmawati [38] also proposed evolutionary algorithms to solve the project allocation problem. Recently, Chiarandini et al. has studied the problem of allocating students into teams working on project topics and proposed a new allocation model using a state-of-the-art commercial solver [39].

Besides all those proposed allocation methods, there are a few things we would like to suggest that could be done to facilitate students in their project selection process. For instance, dividing the projects into main research themes would allow the students to browse only the projects of their research interest and thus would not only save their time but also help them focus more on the topics of their interest instead of random project browsing. Moreover, even inside a specific theme, the sequence in which the projects appear to the students plays an important role in their selection-making process. If a student has to go through 50–100 projects, the level of their interest would drop significantly for the projects that appear later on in the list. Therefore, it is recommended to make the project display sequence random such that each student sees the projects in a different order. This will ensure that all projects are given equal attention by the students. This will also help in balancing the load among different staff members. Finally, the project titles and descriptions should be as concise as possible to let the students browse more projects in less time while keeping their focus intact.

4.3. Project Themes

The project allocations are very much related to the project themes offered to the students. Some themes might be of more interest to the student than others. This could disturb the balance between different themes, and subsequently, the staff responsible for supervising the projects related to those themes. Therefore, it is recommended that the main project themes should be selected carefully where one clever way of doing so could be the alignment of the projects with the modules that students have previously taken in their degree program. It is probable that students tend to work on the projects and feel confident in selecting the topics for which they have some previous background knowledge and do not feel comfortable with topics unfamiliar to them. A common comment of examiners about final year projects is that students do not appear to have been adequately prepared. This is confirmed by research into the student experience of dissertations by Todd et al. [40]. Another way of making students well prepared is to start preparing students for their final year project from the day they start their degree in higher education. Healey and Jenkins [41] described the pedagogical shift that is beginning to occur through examples of degree programmes, where students are introduced to research

from the start of their degree. It is worth mentioning that over 80% of students at the Massachusetts Institute of Technology (MIT) undertake at least one undergraduate research opportunity programme, often in their junior year, mostly in addition to their studies, according to the report by Huggins et al. [42]. Therefore, effort should be made to synchronise the project themes with the major learning outcomes of the previous courses taken, as well as start preparing students for their final year project from the very beginning of their degree programme. This would result in better student performance on their projects, as well as a lower supervision load for the staff.

4.4. Supervisor's Profile

It is one of the important factors when it comes to the project allocations that some of the staff members are relatively more popular among students than others. There could be several reasons for that including the supervisor's research profile, the research group, good teaching skills, friendly student rapport, etc. According to the students' responses presented in Stefani et al. [43], the primary expectation of a student from their supervisor is "to ensure the student is on the right track, offering constructive criticism and offering guidance when necessary". It is also evident from the report of Todd et al. [40] that supervisors who provide constructive feedback on draft work are highly appreciated. The report also argued that approaches adopted by tutors towards supervision varied greatly in terms of formality. Certain supervisors had a relatively relaxed approach, initiating preliminary meetings but then leaving it to the student to request support when needed, with others being more formal and directive, e.g., establishing a supervision timetable for the year; producing a written record of each meeting and drawing up a formal contract of rights and responsibilities. Although the majority of interviewed students thought that the latter approach was useful for them, there were many who preferred supervisors adopting the former approach.

In academic environments, it is observed that such student preferences create healthy competition among staff members; however, the development of enviousness for popular staff members is also produced. It should also be noted that there is a student preference divide for local supervisors versus foreign supervisors in the context of TNE programs. This impacts the student preferences and therefore staff loading. We recommend avoiding such issues through incorporating appropriate constraints in the allocation strategies.

4.5. Industrial Projects/Community-Based Learning

With students having ambitions to join top industries after graduation, the industrial projects could pave their way to the doors of those industries. While the academia-industrial collaboration is important in many aspects, final year projects could play a critical role in strengthening that relationship. There is considerable evidence that student engagement with external employers benefits their learning while making a practical contribution to communities and companies. Mason O'Connor et al., for example, note that the literature on community engagement through the curriculum suggests it enhances the quality of academic work, employability and lifelong learning [44]. Moreover, Lee et al. claim that external engagement with real issues has been shown to increase students' confidence through placing them in positions of responsibility and exposing them to a greater diversity of learning experiences [45]. There are other benefits of engaging in community and work-based learning for students, such as the development of critical thinking, gaining insight into the complex nature of knowledge, showing enthusiasm for a subject and greater subject-related understanding [46,47]. For TNE programs involving China, there are huge industrial project opportunities that should be explored and the students should be provided with the option to work on industrial projects.

4.6. Staff Load Balancing

The project allocations are hugely impacted by the supervision load a staff member could be assigned. With a small student number, this issue may seem irrelevant, but with hundreds of project supervisions to be done each year in TNE programs, the staff supervision load balancing becomes

critical. According to MacKeogh [48], the traditional role of the supervisor is to provide guidance, advice, instruction, encouragement and support; however, it is also the supervisor's role to assist students in their management of conflicts and risk. On top of that, the supervisor acts as the student's examiner, providing formative and summative feedback throughout the learning process. This traditional role can place huge pressures on academics and overload them when they are supporting a large number of students. Hensel and Paul express their concern noting that undergraduate research often takes place outside the curriculum; therefore, recognition of the time that supervision takes may be an issue [49]. As such, it is vital to ensure that no staff member is overloaded while the student project preferences are also met with reasonable success. Moreover, it is required that the supervision load balance between the local staff and foreign staff is determined for the smooth implementation of allocation procedures in TNE provision.

5. Challenges and Solutions in TNE Project Allocations

In all the TNE programs, the final year project allocations process comes with additional challenges and constraints. Working transnationally is likely to raise challenges that stem from differences in culture, educational background and expectations. Transnational teachers find themselves living and working (albeit temporarily) within environments that are culturally different to their own. Their initial interactions are likely to engender "culture shock" [50]. They might find that some of these cultural differences have an impact on how they teach within the overseas setting.

Teacher burnout is a serious risk within transnational education. Many TNE teachers report extreme tiredness fuelled by lengthy international travel [51], jet lag and intensive teaching patterns. TNE faculty members are often pushed to their physical limits and still have to enter the classroom and perform professionally. Smith [50] explains this as *"you're literally flying in, your eyes are shutting and then you're having to teach"*.

One of the most challenging aspects of delivery of flying-faculty teachers is that contact is often based on very short and intensive teaching blocks [52]. As such, teachers may have to work through new models of teaching that enable the material to be covered in a much shorter period of time. It is important to mention here that this kind of intensive block teaching is often criticised for having little to do with pedagogy and more to do with convenience [53]. After delivering a week of intensive sessions, many TNE teachers fly back to the home country and start teaching there from the next day. Debowski [54] reports that one of the most difficult things about working transnationally is managing workloads in two locations.

Language can be another challenge for academics working transnationally. Many students often struggle to keep up with the reading that is required, or have difficulties expressing themselves orally [55]. Therefore, teachers need to be aware of their own language: speaking clearly and not too quickly, explaining key concepts using simple words and leaving time at the end of sessions for students to ask questions.

While student engagement is a critical component of any TNE program, this engagement becomes even more important for final year project supervisions. The project allocations should consider this point and make sure that student engagement is not compromised due to the allocation outcomes. Since for most TNE programs, like GC-UESTC and QMUL-BUPT, the non-local staff operate using a fly in, fly out model and perform block-based teaching, there may be fewer opportunities for activities and face-to-face contact with project students. These challenges could be resolved through the use of technology where, for example, the staff are recommended to integrate the contemporary communication tools like Skype, WhatsApp, WeChat (a popular connectivity tool in China), etc., in their day-to-day communication with students to provide a healthy supervision experience to the students. However, Augustsson and Jaldemark note that online supervision requires a different skill set, as online supervision relies mainly on written communication around electronic drafts [56].

At the same time, the role of a second supervisor also becomes important. It is recommended that for all the non-local first supervisors, a local second supervisor is allocated. This allocation must be

done carefully in order to match the research interests of both first and second supervisors. Thus, the local staff could contribute efficiently to student supervision in the absence of the non-local staff.

It is a possibility that students may have a tendency to prefer the staff from one partner university while making their selections due to several reasons. For instance, the global visibility of the staff, on-campus availability of the staff, lack of communication skills in a non-native language, etc. While student preferences could become biased towards one side or the other, the allocation procedures should be defined in a way to restrict such biases. One of the possible solutions to this problem could be making sure that the students include projects from both sides in their preference list and then assigning appropriate weight to the student preferences. This would take the student preferences into account as well as keep the balance in the supervision numbers for the TNE partner institutions.

6. Conclusions

In this paper, an overview of final year project allocation strategies and procedures is presented. The focus of this paper is on the context and related challenges of final year project allocations in the TNE provision with large student number supervision requirements. We have presented the details of project allocation procedures for two extremely successful TNE programs. While student staff pre-agreement before allocations provides control to staff and students regarding project allocations, it may not be a scalable solution for a large student population, which is a common feature of many TNE programs. On the other hand, the matching algorithm under student preferences happens to be a scalable, fair and efficient allocation process. However, in order to accommodate staff and student involvement, a pre-allocation process at a relatively small scale is recommended prior to the matching algorithm's execution. We have also presented the factors that are important to consider while allocating projects for TNE programs. Towards the end, we have highlighted some of the challenges associated with the TNE programs and the project allocations in the TNE context. We have also made recommendations to improve the final year project experience for both staff and students generally, and to improve the project allocation procedures specifically.

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