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Understanding the barriers faced by TNE-students when completing advanced-level laboratory-based practical classes

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Abstract

This study reports the barriers faced by Transnational Education (TNE)-students when completing practical work in the UK, having transferred to the UK for their final year of study as part of a chemistry degree. Self-identified barriers these students faced included the following: recall of information, difficulties writing the technical reports required for assessment, different educational cultural norms between China and the UK, especially in relation to health and safety, and a lack confidence using English, in particular with the technical language. It was noticed by both participants and researchers that there was minimal interaction with the domestic students and prevalent use of Chinese within the TNE-students' social group, which may have created a 'cultural enclave'. The results from this study have been used to derive a number of recommendations for practice for TNE-programmes that contain a significant practical element.

Keywords

chemistry education, practical work, learning environment, UK, China

Introduction

In recent years, the number of Transnational Education (TNE)-partnerships between the UK and China has grown considerably. Within a TNE programme, the education is delivered in a country

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other than the country in which the awarding institution is based. The content of these programmes usually mirrors that of the UK-based programme, and the TNE-students can usually transfer to the UK for their final year of study, but there are some instances of students spending two years in China and two years in the UK, or all four years in China, referred to as [2+2], [3+1] or [4+0] degree programmes. In order to transfer to the UK, students have to fulfil academic for subject-specific knowledge and English-language knowledge. In many cases, the UK HE provider ensures that students learn English formally alongside their studies in China and complete an IELTS (or equivalent) assessment before transfer. It should be noted that in this article, a TNE-student is defined as a student 'studying a higher education degree programme leading to a UK qualification in a country other than the one in which the awarding institution is located. This includes joint, double or dual awards' (Universities UK International, 2018), whereas an international student is an individual enrolled in an HE institution who has a temporary student visa and has travelled to a foreign country to specifically study for their whole qualification in that country. They may be either a non-native or a native English speaker. Much research has been undertaken that considers international students, but there is less research into TNE-students who are in a foreign country for a small part of their qualification. The research question addressed in this article is 'what are the barriers that Chinese TNE-students face, upon transferring to the UK as part of a TNE-programme, when completing advanced-level practical classes?'.

Barriers faced by students upon transfer to another country

Students that transfer to another country, either for one year of study or to complete their whole programme, face numerous pressures that could act as a barrier to integration and attainment. It was noted by Vygotsky (1962) that social interaction plays a vital part in 'making' meaning, and international students will likely make meanings with the help of cultural tools, especially using language, both between themselves and by interaction with local students. However, there have been a number of studies showing that international students face barriers that may reduce these rich interactions. True integration, both academically and socially, into the host culture or society by these students is unusual (Li & Pitkänen, 2018). One reason for this may be that student mobility is seen as temporary and many students study in the host-country for only one year.

The language barrier arguably has the biggest impact upon international students' integration with the local cohort, particularly if they are non-native English speakers, and this barrier will have significant impact upon the social and cultural integration of these students. Confusion arising from the language barrier may lead to a lack of cultural appreciation due to misunderstandings, as one party cannot communicate effectively with the other. Lee and Rice (2007) showed that in the United States, students from Western cultures and English-speaking countries integrated into the host society much more efficiently and were discriminated against less, for example, by being ignored or verbally insulated, than those students from other countries. In terms of language required for academic study, Ramsay et al. (1999) showed that international students faced difficulty during lectures in relation to vocabulary required and the speed of discourse. More recently, Ramburuth (2001) showed that international students in their first year of study in a foreign country face language barriers for written assignments. In addition, the key study skills required to succeed, for example, listening ability, reading comprehension, note-taking, oral communication, vocabulary and writing have all been identified as difficult for international students (Andrade, 2006; Edwards et al., 2007; Lee, 1997). A survey by Zhang and Mi (2009) reiterated that listening and speaking are aspects that international students find most difficult, but interestingly that these issues are confined to the first two years of study abroad; if a student is enrolled upon a programme where they transfer abroad for one year of study, the likelihood of adjustment and successful integration is small. This is of particular importance for TNE-students

enrolled upon [3+1] programmes, as the year of study abroad is the final year, which is often high-stakes. For example, the final year for the students in this study accounts for two thirds of the overall degree outcome.

Another major barrier faced by specifically by Chinese students is the difference in learning styles between the UK and China. Studies that look into 'Chinese learners' tend to refer to students who are either Chinese-speaking or share Confucian heritage (Wu, 2015). This broad-brush approach ignores diversity within different Chinese cultural groups and societies and fails to distinguish students from areas of China that may have different educational norms, for example, Hong Kong, which is more familiar with the British educational system, compared to mainland China. There have been a number of cross-cultural studies in recent years that have considered the sociocultural impact of learning upon international students' learning practices and beliefs (Durkin, 2011; Edwards et al., 2007; Gu et al., 2010; Ryan, 2011; Tian & Lowe, 2013) and much of the research specifically concerned with the social integration of Chinese students has focussed on their academic life, in particular their participation in class (Hodkinson & Poropat, 2014; Liu, 2002), styles of learning (Lixian Jin & Cortazzi, 2006) and levels of academic attainment in relation to their peers (Crawford & Wang, 2015). However, there have been fewer studies specifically looking at the integration of Chinese students into a cohort from the Chinese students' perspective. Spencer-Oatey et al. (2017) sought to address this by investigating both postgraduate and undergraduate Chinese students' levels of satisfaction with integration into the university student community, and any barriers that the Chinese students perceived to becoming more socially integrated. They found that many Chinese students were dissatisfied with the opportunities for friendships with British students and found it more challenging to socialise with non-Chinese students. One of the major barriers cited was cultural distance, but in addition individual factors, for example, personality, or preference for the 'easy option' of not integrating, also had an impact. An earlier study by Spencer-Oatey and Xiong (2006) showed that Chinese students faced more difficulties when socially integrating at a UK university than they did with adjusting to academic life. A study by Wu (2015) considered the experiences of Chinese postgraduate students at UK HE institutions. Wu suggested that meaningful intercultural learning could only occur if students and teachers share mutually defined practices, beliefs and understanding and that both teachers and students need to be sensitive to their cultural diversity.

In the case of TNE-students in this study, there is a danger that teachers and other students could assume that the style of learning the TNE-students were exposed to prior to transfer is identical to that experienced by the UK-based students because the curricula are closely aligned. In reality, it is more likely that the teaching and learning styles between the UK and China will be different even though both parts of study contribute to one overall qualification.

Barriers faced by students in programmes with a significant practical element

The findings outlined above are usually confined to studies where the majority of education takes place in a classroom environment, under a 'traditional' lecture regime. Where students are enrolled upon programmes with a significant practical component, students will undertake both classroom-based lectures and laboratory- (or field-) based practical sessions. Arguably, a laboratory (or field) environment combines both cultural factors relating to how the learning assignments are delivered and expectations for what students achieve during the session and social factors because there are ample opportunities for interaction between student cohorts. For example, within the laboratory environment students are often expected to work together, either to solve a problem, or to provide support with particular techniques or experimental detail. The laboratory environment is busy, and as such these interactions are often rapid and information-rich, occurring while a student is undertaking a technical operation.

Within the field of chemistry, much work has been dedicated to investigating the role of practical classes and the rich learning experience that can be experienced by students upon taking part. A comprehensive review by Hofstein & Lunetta (2004) outlines some of the key findings, and Reid & Shah (2007) developed a set of four holistic aims for laboratory skills development. Importantly, the practical laboratory is recognised as being a rich environment for enabling cooperative and collaborative relationships between students and for the development of a classroom community of scientists. However, the clear articulation of the goals of a practical class is necessary to achieve meaningful learning by students (Bretz et al., 2013). Students who work collaboratively have been shown to outperform those students who work individually in both cognitive achievement and processing skills (Lazarowitz & Karsenty, 1990; Okebukola & Ogunniyi, 1984); therefore, social integration is important. In addition, the informal atmosphere and opportunities for social interaction between students and instructors can lead to a healthier learning environment (DeCarlo & Rubba, 1994; Tobin, 1990) and development of a student support network. However, interaction and intervention by an authority, that is, an instructor, is essential (Driver, 1995).

Alongside any language and integration barriers, there will also be additional challenges that may have an impact upon these students' attainment. It has been shown by many researchers that the cognitive requirements upon students when completing practical tasks, even for native-speakers, are high. Cognitive load theory was developed by Sweller in the 1980s and provides a description for the amount of mental effort that is expended in any given learning scenario (Agustian & Seery, 2017; Sweller et al., 2011). It has been suggested that if the cognitive load is too high, learning opportunities can be missed (Johnstone & Wham, 1982).

Using the arguments outlined thus far, it can be argued that for students enrolled upon a TNE-programme where the final year of study is spent in a foreign country, and that year contains a significant practical element, the barriers to achievement are likely to be high. The literature exploring the impact of completing practical classes on TNE-students, particularly those in a host-country for one year of an extended degree programme, is ill-defined. One publication compares TNE-students' expectations of academic life in the UK with the reality of study in the UK (Cranwell et al., 2019), and the other explores the difficulties faced by these students when interacting with other laboratory users (Cranwell et al., 2021) but neither considers the more general barriers that students face when completing practical work in a laboratory. We therefore sought to address the following question using a mixed-methods study: What are the barriers that Chinese TNE-students face, upon transferring to the UK as part of a TNE-programme, when completing advanced-level practical classes?

Methods

Data collection

A mixed-methods approach (Bergman, 2008; Hesse-Biber, 2012; Johnson & Onwuegbuzie, 2004) was used, with three modes of data collection: questionnaires, one-to-one interviews with selected participants and observation/video recording of practical classes by the researchers. Data were collected after the TNE-students had been studying in the UK for three months. The students were recruited by presenting the researchers to them during a teaching session and giving them invitation cards with contact details. Student participants who volunteered to participate in the research could contact the researchers by email. There were 13 student participants who were all from the same educational institution and enrolled upon the same [3+1] chemistry degree programme.

Questionnaires

Questionnaires were written in English and translated into Chinese, and participants answered the questionnaires in Chinese. Questionnaires comprised a selection of open and closed questions and Likert-style items to allow collection of data that could be both statistically analysed for significance and assessed and coded by adopting an inductive qualitative content analysis approach, where written or oral materials were grouped/classified into categories of similar meanings (Cho & Lee, 2014; Elo & Kyngäs, 2008; Moretti et al., 2011). Answers to open questions were translated back into English for evaluation, and answers coded into themes. All open-ended questionnaires answered were considered by all the researchers, and all researchers agreed about themes identified to ensure data reliability. Statistical analysis was completed using SPSS.

Interviews

Semi-structured interviews were conducted in Mandarin, allowing participants to express themselves more freely and the interviewer to steer the conversation into areas that could provide richer insights. Ten interviews were undertaken. Transcripts were translated *verbatim* into English by a native Chinese-speaker and responses thematically coded by the researchers by looking for both salient and recurring themes. Coding was a two-phased inductive process. First, questionnaire answers were coded into broad themes, which were then honed into sub-themes to show more specific findings. As with the open-ended questions in the questionnaire, the interview transcripts were considered by all the researchers and all researchers agreed about the themes and sub-themes identified to ensure data reliability.

Laboratory Observations

Observations involved two modes of data collection. First, three TNE-student participants volunteered to wear an 'Apeman' camera mounted on the body for three sessions of 30 min each and each student was observed by a researcher. These sessions were at differing times throughout the practical work: the beginning of the session when students were setting-up their experiment(s); the middle when experimental data were being collected; and the end when experimental results were being analysed. This allowed oral discourse to be captured on film and the researchers to look more closely at key interactions. The researcher collected written notes and the same researcher observed the same student for each of the three sessions. In particular, the researchers were looking for the frequency of interactions between the different laboratory users and for behavioural clues to suggest that there were any barriers to interaction or integration. The visual and oral material collected during the laboratory sessions were reviewed by all researchers, and key observations were noted and triangulated with the results from the interviews and questionnaires as described in the following section.

Participant information

All of the students in this study were in their final year of a [3+1] Applied Chemistry degree programme and had transferred to the UK. In the foundation (year 1), the chemistry content is similar to that of the UK A-level. In years 2 and 3, the core chemistry content and assessment are aligned with the UK programme specification. During all years, students are taught general and subject-specific English language. To transfer, all students must achieve an average score of 6.0 in their IELTS (or equivalent) English Language test with no score below 5.5. In addition, students must have achieved an average of 70% in all compulsory chemistry modules. In year 2, students

complete 40 credits of Level 4 practical work, and in year 3, students complete 30 credits of Level 5 practical work, which is aligned as far as possible with the UK curriculum. Upon transfer to the UK, the TNE-students complete lectures and practical classes alongside the domestic students as well as specific skills and English Language modules. All students complete 20 credits of Level 6 practical work in term 1, which prepares students for an independent research project accounting for 40 credits in term 2. At the time of data collection in this study, the TNE-students were completing the 20 credit practical class in term 1 in the UK. To the best of our knowledge, no students in this study have experience of studying in another country.

In China, students typically work in groups of two or three to complete a practical exercise. Classes are between two to four hours in duration, contain between 40 and 60 students in one laboratory, and students usually complete one or two classes per week over a twenty-week period. In the UK, there were 30 domestic students and 13 TNE-students in one large laboratory, all completing a nine-hour practical session once per week for ten weeks. This large group was sub-divided into three groups of approximately 16 students that comprised five UK-student pairs and three TNE-student pairs, which is standard practice. There was one trio of TNE-students. The student pairs were interspersed, with a pair of UK students working alongside a pair of TNE-students. In both the UK and China, students are expected to undertake preparatory work before the class and write a report after the class. The domestic students complete ten laboratory reports over the ten-week course, one for every experiment, and the TNE-students complete three which are evenly weighted and are required approximately once every three weeks. The three reports contribute 85% to the total module mark. The remainder of the marks are allocated to an online pre-laboratory quiz and assessment of their practical skills during the class. During the class students are expected to maintain a laboratory notebook, where they note any observations and operations that they completed.

This research received Research Ethics Board approval from the International Study and Language Institute at the University of Reading.

Results

The results from the questionnaires, observations and interviews showed the major barriers the TNE-students reported when completing advanced practical classes in the UK could be grouped into four main categories, namely: preparation for, and subsequent follow-up of, practical work, language and communication with other laboratory users, the academic transition to the UK and health and safety expectations. The key findings for each of these areas will be outlined below and data will be presented collectively.

Preparation and follow-up of practical activities

All students (13 students, 100%) prepared in advance for practical classes, with the majority of students (92.3%, 12 students) stating that the preparation required took longer in the UK compared to in China. The aspect of preparation identified as requiring most time was completion of a Control of Substances Hazardous to Health (COSHH) form. Although this made preparation take longer, students all agreed that it was a worthwhile activity.

Follow-up work, which was usually a scientific report, provided a much larger barrier to students than the preparatory work. The main challenges faced were interpreting and analysing data when an issue was encountered and required help during the session. Often the language barrier meant that the teacher's explanation was hard to understand so meaning was lost and students struggled when trying to recall the explanation at a later time.

> 'Mainly, for example, if we write a report, and something accidently happened during the experiment, we have to analyse it ourselves. But at the time of noticing something wrong, I asked the teacher, in this process, the teacher's explanation may be quite hard to understand, I might have understood at that time, but still might not understand when I thought about it again'. (S1)

Another challenging aspect was the technical language and requirement for scientific referencing in the report. The TNE-students had not previously used scientific referencing, and a lack of familiarity with scientific English terminology slowed their progress significantly:

> Student: 'For a report, usually I can type in Chinese quite fast, but it feels like typing one letter at a time in English'.
> Interviewer: 'Is this because it is terminologies or normal words?'
> Student: 'Just normal words, because the report needs to be written professionally. It's not the same as writing in ordinary text. It's more difficult to polish the word, it takes more time, and it requires a lot of thinking, we have to find professional knowledge to analyse the results of a section'. (S2)

However, although the writing of scientific reports was a barrier that students faced, a number of students commented that the physical process of writing the report, and the ownership that completing an experiment and then presenting the results gave them, was positive.

> Interviewer: 'How helpful is the practical class for learning on your programme?'
> Student: '… In the process of writing a report, we need to understand the whole block of knowledge and we need to integrate them. We basically become familiar when we do the experiment. Or you can say, we know better for that piece of knowledge'. (S3)

And another student stated that the whole process of the practical classes (preparation, completion of experiment and writing the report) was significant for enhancing their understanding,

> 'From the preparations before the experiment, the safety of experiment, the pre-test exercises, to the process of experimenting. With special emphasis on safety, and the characterization/appearance after the experiments and from the beginning to the end, the whole series of things, we could experience better experimentation. At the end, we need to write a report. I found it is very helpful to write this report. I could learn a lot from the experiments'. (S4)

Language/communication

The language barrier was frequently cited by students as contributing to difficulties when communicating with other occupants of the laboratory. When asked 'are there any barriers to communication with British students', 76.9% (10 students) stated that there were, with 23.1% (3 students) stating that they were 'not sure'. In the free-text comments that followed, the rate of speech and the vocabulary required to chat and express thoughts and feelings with the local students were mentioned as contributing to the barrier. It was noted by one student that most students from other countries like to stay as a small group; therefore, breaking barriers between social groups is difficult:

> Interviewer: 'Do you think students from other countries, including British students and students with other nationalities, communicate a lot with you?' Student: 'Not really'. (S5)

When communication did occur, the outcome was generally positive and both parties were willing to help each other, but the main difficulty was knowing how to instigate conversation in the first place. It was mentioned by some students that having mixed-nationality pairings in the laboratory would have been a positive outcome and would have provided an opportunity for enforced communication and therefore integration. On the whole, the limited communication between both bodies of students was seen as negative by the TNE-students:

> Interviewer: 'If you can make your own choice, would you choose to be with a student from [China] or…?'
>
> Student: 'Probably with a local student. Because I came here to learn more from them and integrate into the lives here'. (S2)

Student responses to the questionnaires showed that the language of communication between TNE-students during the practical sessions was 'mostly Chinese with some English' (85% students, 11 students), with some students (15%, two students) consistently speaking to their TNE-classmates in Chinese only. This was also noted during the observations and commented upon during the interviews. When the reasons for predominantly using Chinese were probed, it was discovered it was for ease and to avoid miscommunication:

> 'We feel it is clearer for us to express ourselves in Chinese. For some English sentences, we do not express ourselves very clearly, and this may cause misunderstandings' (S6).

Transition to UK-study

The majority of students (76.9%, 10 students) stated that their initial experiences of practical work in the UK had met their expectations. In particular, the opportunity to work with modern instrumentation and to analyse data that they had collected was extremely positive and a major benefit of experience in the UK.

> 'There are infrared and nuclear magnetic instruments [in the UK]. For organic chemistry experiments in [China], we only need to get products and the yield. However, in [the UK] when I get an organic product I need to measure its IR, to see what we are producing, to analyse the purity, and if the product is the one we want'. (S9)

Students were generally in agreement that the laboratory classes were a good way of learning new skills and developing as a student. It was suggested by one student that completing the practical class was easier than lectures because, although the language required generally provided a barrier, students felt like they were in control of the outcome and minimal use of English was required to complete the operations. As confirmed during the interviews, most TNE-students read the experimental procedure before attending the laboratory session and made notes in the margin in Chinese which they referred to during the practical session. As commented by one student,

> 'Actually, I think the experimental class is already the easiest course for Chinese students in all courses in the U.K. Because there are no language barriers, the operation is relatively simple'. (S8)

And later during the interview,

> 'I think the experiment class is nice. Normally, when I listen to lectures I still find them difficult to follow. The experimental class is still relatively easy compared to others. We can understand it to a great extent and handle it. I think it is quite good'. (S8)

As noted earlier, this practical course contributes 20 credits (10 ECTS) credits to a student's final year of study, so the stakes for each assessment point are high. This was also suggested to be a reason for the lack of mixed-nationality pairing,

> '[at the beginning of the module] we thought that we had to group up with foreign students. I asked the teacher at that time and the teacher said it was possible. But it never happened…because some experiments are summative, perhaps [the UK students] are not particularly willing to be in the same group with us' (S1)

along with the potential for conflict due to the language barrier

> 'the teacher is a bit worried that there will be a language barrier between Chinese students and local students if they were grouped together, less communication, or one person does more work than the other, may cause a bit of complaining, he/she is worried about this which may start a conflict. He/she said some people in the last year weren't happy about it' (S2)

Health and Safety Expectations

One area that was significantly different between the UK and China was the approach to health and safety within the laboratory. All TNE-students made comments about how the culture surrounding practical work in the UK was different to in China in many aspects, including the requirement for risk assessments before practical work was undertaken, the necessity of PPE and working within a fume hood. In terms of adjustment to academic life in the UK, this was a major change for all of the students. During some of the observations, the researchers noticed that sometimes the TNE-students did not fully adhere to local health and safety rules, which seemed to provide a source of tension with the local students. It was noted that this lack of compliance was not intentional, and when reminded of the local rules the TNE-students were very quick to comply again. The emphasis on health and safety, although seen as a major change for the students, was seen as positive and something that the students would have liked to have seen more extensively in China,

> 'The importance attached to safety here is very high. They will never allow us to stay alone in the laboratory…in [China] we do not have this kind of strong awareness, we did not do experiments in fume hoods.…Here, all the chemicals need to be kept in the hood and opened in the hood in experiments'. (S7)

Discussion

The TNE-students in this study transferred to the UK for the final year of their BSc studies and completed advanced practical classes in a chemistry laboratory alongside the domestic students. This work has revealed, for the first time, some of the barriers that TNE-students face when completing these sessions. These barriers are in addition to the difficulties that students ordinarily face when completing practical work. It is likely that these socio-cultural differences, particularly those relating to language and cultural expectations relating to practical work, contributed to a lack of interaction between the TNE-students and other laboratory users. Our results show that Chinese students are using whatever language-based meaning tools they have available to them, including

their mother-tongue, to accomplish the laboratory tasks and assessments. However, communication barriers between themselves and the UK home students resulted in lost opportunities for useful information, social exchange and a less fertile learning environment. This likely prevented successful socio-cultural integration of the TNE-students with the domestic cohort.

The TNE-students found the use of English language within the laboratory difficult due to the speed of discourse and the vocabulary required, which supports findings by Zhang &Mi (2009), Edwards et al. (2007), Andrade (2006), Ramsay (1999) and Lee (1997), although these findings were identified in a classroom setting. The TNE-students found it difficult to recall any explanations that they had been given during the practical class because all explanations were in English; therefore when completing assessment, students could not always incorporate new knowledge or findings because they could not remember them. It has been noted that English language skills are important for the academic and social adjustment of TNE-students (Yeh & Inose, 2003), and that a lack of English proficiency can be the biggest barrier to academic achievement and social engagement with other students (Andrade, 2006). The use of Chinese by the TNE-students may be perceived by the domestic students as creating a 'cultural enclave' and excluding them (Chen & Ross, 2015). However, the TNE-students stated that it was easier and faster to talk using Chinese. This links with research from Tompson and Tompson (1996) who showed that there were two contrasting viewpoints relating to TNE-students creating a 'cultural enclave': professors interpreted TNE-students sitting near to each other in class as being unproductive and contributing to their lack of participation'; however, the students felt that this was crucial for building a support network where the language and rules and regulations were familiar. Combining these language aspects with working in an unfamiliar laboratory environment within time constraints will lead to substantial cognitive load and reduce the free capacity for students to process new information (Johnstone & Wham, 1982), which is probably why students could not remember explanations at a later date. In addition, it is likely the pressures of the high-stakes assessment, where the reports contribute 85% to the overall module mark, would further reduce the likelihood for spontaneous interaction as both cohorts are working for credit.

The TNE-students have transferred to the UK from China for their final year of study. These students are expected to adapt to the differing educational expectations and practices in the UK compared to China as well as the socio-cultural aspects of 'fitting in'. Chinese students have been shown to be highly adaptable at making this change and if they are successful, they are able to improve their linguistic competence, increase self-confidence and become more independent learners (Gu & Maley, 2008). However, even though these students have been shown to be adaptable there still needs to be compassion and understanding from the host organisation. Li and Pitkänen (2018) note that many Chinese students studying in Finland wish to undertake cross-cultural communication and companionship during their studies abroad, but establishing friendship groups and networks is not easy. They noted that for international students establishing 'co-national social networks' was much easier and provided students with the information needed to live in their host country, as well as social and psychological support. A number of TNE-students stated that they did not know where to start conversation, or how to break the social barriers to allow conversation to flow. This is in-line with Spencer-Oatey (2017), who showed that if there was no requirement for TNE-students to interact with the domestic cohort many students take the 'easy option, of not doing so. However, this issue is likely compounded in the laboratory by time-pressures on these students. A study completed by Smyth and Banks (2014) upon secondary school students in Ireland showed that those students who had more positive interactions with their teachers exhibited reduced stress levels. This is likely the case here too; ensuring that the TNE-students had time to interact either with academic staff or other students would be wholly positive.

An area where there is a large cultural difference is when discussing health and safety. One of the main objectives within a UK chemistry degree programme is learning how to work safely within the laboratory, for example, by wearing PPE, and considering any risks or hazards associated with a particular reagent or synthetic procedure. The differences between the UK and China were very clear, in particular relating to the UK requirement of completing COSHH forms prior to undertaking practical work and undertaking all practical work within a fume hood when the risk assessment requires it. Students in the UK are taught the importance of health and safety during their A-level studies and continually throughout their university studies. Within the UK-based curriculum, the development of health and safety skills is an integral part of a student's development and is assessed continually and is required by the Royal Society of Chemistry during accreditation (Royal Society of Chemistry, 2015). The TNE-students all commented upon this cultural difference and were sometimes observed not adhering to the local health and safety rules, which led to tension with the local students. This may have actually provided a barrier to positive interaction between the two cohorts, as the domestic students may have felt that they had to enforce health and safety rules and were therefore taking a managerial role, rather than that of a peer.

Finally, one major contributor to the lack of interaction that is often overlooked is the layout of the laboratory itself, although there is not easy solution to this. When working on an experiment each student, or pair of students, works with their hands inside the fume hood and their back to the room, so the body language is closed and in order to communicate the other interlocuter needs to come quite close. In addition, the laboratory is a very busy and noisy environment, requiring laboratory users to talk loudly and clearly or stand quite close. These factors mean that it is unlikely that spontaneous interaction between the two groups of students would happen unless the students knew each other well already, or there was a specific reason to interact. The lack of interaction between the TNE-students and the domestic students likely led to a number of missed learning opportunities, both academic and social, which have been shown to have positive outcomes for all parties (Driver, 1995).

Implications for practice

Glass and Westmont (2014) suggest that a holistic approach towards student integration should be taken, where socialisation and identity factors are taken into account alongside teaching and learning. This should also be applied here to facilitate overcoming the barriers that these students face. In addition to the teaching and learning experience, Spencer-Oatey and co-workers (2017) argue that integration can lead to a range of positive outcomes including student satisfaction, future employability and academic success. The findings from our study lead to the following suggestions for practice:

- Ensure that there are opportunities for cross-nationality partnerships and interaction, for example, by mixed nationality pairings.
- The students in the host-country should be prepared as much as possible for the arrival of a cohort of TNE-students.
- Assessment and practices should be aligned between the partner and host institutions to lessen the cultural shock faced upon transfer.
- TNE-students should be prepared in terms of their technical English language upon transfer to the UK. Host-country staff and students should be alerted to likelihood of communication issues and the different methods that they can use to facilitate communication with the TNE-students.
- Host-country teaching staff should be sympathetic of the significant cognitive load upon the TNE-students during practical classes.

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