# *A study into the challenges faced by transnational education students (TNE) upon integration into advanced STEM practical classes through investigation of the oral learning environment*

**A study into the challenges faced by transnational education students (TNE) upon integration into advanced STEM practical classes through investigation of the oral learning environment**

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## Introduction

A transnational education (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"* (HE Global report, 2016). In recent years, the number of students studying on transnational degree programmes has increased significantly. In 2012–13 there were 598,925 students studying on transnational courses (undergraduate and postgraduate), which rose to 701,010 by 2015–16 (Universities UK International report, 2018). The majority of TNE-students at undergraduate level were from Asia (41%), with Malaysia and China having the most students enrolled on undergraduate programmes (44,690 and 23,615 students, respectively). In Malaysia and China, a significant number of students study for their qualification wholly overseas. During a TNE programme, course delivery may be through one, or a combination of, three main modes (HE Global report, 2016):

- Distance/online learning, either with or without local support.
- Local delivery partnerships e.g. franchised delivery, joint and dual degrees, twinning arrangements, validation and quality arrangements.
- Physical presence e.g. branch campus, study centre or 'flying faculty'.

Within chemistry, there has been a rapid growth in the number of TNE providers, particularly between the UK and China. Delivery of these programmes is usually through a model where students study for two, three or four years in China and, if the programme allows, transfer to the UK for their final year. These models are

referred to as [2+2], [3+1] or [4+0], respectively, with the former number referring to the number of years the student spends in China and the latter the number of years students spend in the UK. In this study, students were studying on a [3+1] BSc Applied Chemistry programme, with content in China delivered by local staff interspersed with short visits from UK-based academics using the 'flying faculty' model (Smith, 2014).

In the programme discussed, the first year of study in China is very general. The second and third years in China are aligned with the UK institution's chemistry curriculum and are taught in English by faculty members in China. During the students' second and third years of study there are two visits from the UK faculty staff per year, each lasting for a fortnight. During these visits some subject-specific teaching by the UK faculty member takes place. While in China, students study both general academic English and Chemistry-specific academic English. In order to transfer to the UK, students need to meet a pre-determined academic threshold in years two and three, and a specific IELTS score. Once in the UK the Chinese students are fully integrated with the UK-based students and share lectures, tutorials and practical classes. The assessment of core chemistry knowledge in this year is identical to that of the domestic students. The TNE-students also have additional assessments relating to the English language module and a bespoke key skills module, each contributing 10 credits (5 ECTS credits) in place of some optional chemistry content. Overall, the year in the UK contributes two-thirds of the credit towards the TNE-students' final degree classification, in-line with the UK-based student cohort. Students attain two BSc degree qualifications, one from each institution.

### *Integration of international students into the domestic cohort*

There has been some investigation of the integration of international students into a domestic cohort, either as international students studying their whole degree in another country, or as part of a bespoke programme with one year of study-abroad embedded (Cranwell *et al.,* 2019; Smith & Khawaja, 2011; Ward, Masgoret & Gezentsvey, 2009). Whatever the mode of study for these students, there are large numbers of reported pressures on them. For example, TNE-students are expected to study and achieve good grades in an unfamiliar academic culture, often in their non-native language, as well as interact with those in their host country and make friends with home students on campus (Hou & McDowell 2014). 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 than those students from other societies. True integration into the host culture or society, particularly by Chinese students, is unusual, and one reason for this may be due to the fact that student mobility is seen as temporary; many students study in the host country for only one year (Li & Pitkänen, 2018). The extent of integration of students will also likely depend upon the degree programme that the students study, and the relative size of the host and international cohort. Some programmes comprise of mainly international students, for example Master's programmes in business, whereas others do not. Subject "norms" and international composition of the cohort has a bearing upon the integration and cohesion of the cohorts.

***Practical classes in the UK***

Many studies into how students undertake learning within the science laboratory have been conducted, and numerous reviews have been published since the 1960s (Hofstein & Lunetta, 1982, 2004; Lazarowitz & Tamir, 1994; Lunetta, Hofstein & Clough, 2007; Ramsay & Howe, 1969a and b; Tobin, 1990). However, there have been fewer studies into the interactions between laboratory users (Lang, Wong & Fraser, 2005), and, to the best of our knowledge, no studies into the interaction and integration of TNE-students with other laboratory users. A practical class within a chemistry laboratory comprising a mixed cohort of international and domestic students, with associated teaching staff, provides opportunities for a multitude of oral interactions between laboratory users.

In the programme in this study, upon transfer to the UK the TNE-students experience a laboratory class module that is significantly different to that in China. The module contributes 20 credits (10 ECTS credits) to the TNE-students' final year grade. There are around 50 students present per session and each session is nine hours in duration. In this time, students complete advanced-level experiments and collect data. There is not usually time to analyse data during the session. Both TNE and UK students work in pairs to complete the same experiments and the pairs are physically interspersed with each other. The assessment of the TNE-students comprises of ten short online tests before each session that each contribute 1% to the overall grade, and three full scientific reports, each contributing 30% to the final overall grade. The class is supervised by one member of academic staff along with a native Chinese-speaking International Support Tutor (IST). The IST's role is to support students academically and pastorally both

before and after transfer to the UK, and also provide extra-curricular support to students throughout the programme. While in the laboratory, there are numerous people that students can consult for advice and reassurance: the IST, academic staff, teaching assistants (TAs), technicians, UK students or their partners. Although manuals outlining fundamental instructions and processes necessary for the experiment are issued, these require further interpretation to allow full comprehension of specific instructions as they are written in a highly technical register. Due to the UK and TNE-student pairs working side-by-side, the opportunities for cross-cultural communication are numerous. The environment is in contrast to that experienced in China where a laboratory session, conducted solely in Chinese, may be two hours in duration, supervised by a single Chinese member of staff who demonstrates techniques at the start and provides written recipe-style instructions.

Within this chapter, trends identified in TNE students' self-reported classroom experience and perception of classroom interaction in a chemistry laboratory within a TNE chemistry program after transfer to the UK are discussed. Although this study considers the integration of Chinese students into a chemistry programme and their subsequent interaction with the UK-based cohort, it is anticipated that several of the issues identified and observations made herein are applicable to other STEM subjects, and subjects with a large practical element involving experiential learning, for example art or film studies. Our preliminary findings are outlined below.

**Materials and methods**

When collecting data for this project a mixed-methods approach (Bergman, 2008; Hesse-Biber, 2010; Johnson & Onwuegbuzie, 2004) was used with three modes of data collection: questionnaires, individual interviews with selected participants, and observation/video recording of practical classes by the researchers. The data were collected after the TNE-students had been studying in the UK for three months. During the practical sessions, all students were arranged into three groups of approximately 16 students that comprised 5 UK-student pairs and 3 TNE-student pairs. This research received Research Ethics Board approval from the International Study and Language Institute at the University of Reading.

### *Questionnaires*

The questionnaires were written in English and translated into Chinese, and were designed to investigate the key interactions of the TNE-students with other laboratory users from a TNE-student perspective. Participants answered the questionnaires in Chinese. The 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 the open questions were translated back into English for analysis. Statistical analysis was completed using SPSS.

### *Interviews*

The semi-structured interviews were conducted in Chinese. Ten interviews were undertaken. The transcripts were translated *verbatim* into English by a native Chinese-speaker and the responses thematically coded by the researchers by looking for both salient and recurring themes among students. The guide interview questions are included in Appendix 1.

### *Laboratory observations*

The participants were observed during the three sessions by the researchers, and notes taken according to key interactions between laboratory participants. 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 of the session when experimental data were being collected; and the end of the session when experimental results were being analysed. The material collected during the laboratory sessions were reviewed. Key observations were noted and triangulated with the results from the interviews and questionnaires as described in the following section.

## Challenges faced during data collection

The main challenge with this investigation was accurately capturing the interactions of the TNE-students with the other laboratory-users. The laboratory is an extremely busy environment and the frequency of interactions is high. In addition, the

laboratory environment can be quite noisy both due to conversations between laboratory users and the use of the fume-hood air extraction system, so accurately hearing the exchanges and documenting was occasionally difficult.

## Results

When in the UK laboratory, all students work in pairs. The UK students already had established laboratory partners from previous years, therefore it was decided by academic staff that pairings would be UK-student–UK-student and TNE-student–TNE-student. The pairings were assigned in the first laboratory session of the year. Upon analysis of interview data, it was seen that the lack of forced integration may have been a hinderance to interaction between cohorts. The TNE-students commented on the lack of mixed pairings as a negative, and one student stated that they would have preferred to have been paired with a UK-based student because of the benefits of integration with the local students:

> **Interviewer:** When you were experimenting [in the UK], you were grouped up with another [TNE]-student. Are you happy with this? Do you want to group up with some students from other countries?
> **Student:** In fact, I still hope to be in a group with foreign students….In fact, I really want to communicate with foreign students.

And

> **Interviewer:** If you can make your own choice, you will choose to be with a [TNE]-student or…?
> **Student:** Probably with local students. Because I came here to learn more from them and integrate into the lives here.

Analysis of the questionnaire data showed that 76.9% of the TNE-students believed that there were barriers to communication with the UK-based students[1] and that there was a great deal of interaction between TNE-students with each other, but less

[1] Are there any barriers to communication with British students? Yes (76.9%), No (23.1%). n = 13.

between the TNE-students and UK-students.[2,3] This suggests that, in line with the findings of Li & Pitkänen (2018), significant interaction with UK-based students was not occurring. When asked to clarify the barriers faced, students cited speaking and listening as major issues. Time-pressures to complete experiments, for both TNE and UK students, and therefore satisfy the assessments were also mentioned numerous times.

> **Student:** There are many terminologies that we could not pronounce. Or I am afraid of not being understood even after I pronounced it. Everyone is doing experiments and it is impossible to read the words slowly. Others need to do their experiments, too.

And

> **Interviewer:** Have you ever tried to communicate with other foreign students outside of your group?
> **Student:** I have tried to communicate. But my listening is not very good, and they speak too fast, so that I can't get used to it. Once he/she talked to me and he/she spoke two sentences, I could not understand either of them, this was quite embarrassing.
> **Interviewer:** Language barrier?
> **Student:** The language barrier is still quite big.

And

> **Interviewer:** Have you taken initiative to communicate with other British students or foreign students outside the group?
> **Student:** Yes, but quite few times.
> **Interviewer:** Is it because you were busy with the experiment or…?
> **Student:** Should be busy with experimenting.
> **Interviewer:** Do you feel foreign students from other groups ever take initiative to communicate with you?
> **Student:** Not really. They were focusing on their experiments.

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[2] How much interaction occurs between you and your [TNE] classmates during a typical laboratory session in the UK? A lot (1), some (2), not much (3), none (4); mean 1.00; n = 13; SD 0.000.

[3] How much interaction occurs between you and your British classmates during a typical laboratory session in the UK? A lot (1), some (2), not much (3), none (4); mean 2.77; n = 13; SD 0.439.

Technical vocabulary was also difficult, particularly the specific vocabulary required within a practical class due to students' unfamiliarity with the words.

> **Interviewer:** Is there any challenge [in the practical class]?
> **Student:** As for challenges, they are mostly in terms of communication.
> **Interviewer:** Like what?
> **Student:** We couldn't express accurately of our opinions. Sometimes the British students are also very confused with what we've said.
> **Interviewer:** The expression is unclear? Is the vocabulary problem still?
> **Student:** Yes, vocabulary problems, terminology. Now we know some of the basic chemistry terms, but we still have difficulties of combining them together.

When communication did occur, it was usually related to experimental techniques rather than day-to-day chatting:

> **Interviewer:** Do you have any initiative to communicate with foreign students?
> **Student:** When we do experiments, we ask each other about yields, etc. Because if we have not done this experiment before, we are not sure if we are doing it well or not. We just compare slightly with each other. They also ask about how to use the instrument, etc.

Student responses showed that the language of communication between TNE-students during the practical sessions was 'mostly Chinese with some English' (85% students, n = 13), with some students (15%, n = 13) consistently speaking to their TNE-classmates in Chinese only.[4] When the reasons for predominantly using Chinese were probed, it was discovered it was for ease and to avoid miscommunication. In addition, students perceived the main goal of practical work to be completion of the credit-bearing experiment rather than improvement of English language skills, which could be learnt after class. For example, one student stated:

> **Interviewer:** Does [talking Chinese] affect your language improvements? Your English improvements?

[4] When interacting with your [TNE] classmates in the laboratory in the UK, which language do you use? Mostly Chinese with some English (84.6%), Mostly English with some Chinese (0%), Chinese only (15.4%), English only (0%); n = 13.

**Student:** I think it is affected. But after all, I regard finishing experiments as my main goal. I could learn the language after lab class in other activities.

Unsurprisingly, questionnaire data revealed that interactions between TNE-students and UK-based staff were likely to be in English with 61.5% students using "mostly English with some Chinese" and 30.8% using "English only".[5] Concerningly, one student "never" talked to UK-based staff.[6] It was noted during observations that the TNE-students mainly interacted with the IST rather than approach the English-speaking UK-based academic staff or TAs. In addition, it was noticed that the TNE-students asked the IST questions in Chinese and the IST answered in English. When asked about this in interviews one student said that although the IST answered in English, the speed at which the IST spoke was more manageable for students:

**Interviewer:** [The IST] usually explains to you in English. But it seems like you normally reply in Chinese?
**Student:** We don't answer much, it's mainly listening to him/her, and we can understand it. Because he/she asks us if we understood or not if it's something quite difficult. Also, s/he doesn't speak fast.

English was used by the TNE-students if they were using vocabulary that they had learnt while in the UK, for example when using chemical names or discussing reaction phenomena.

**Interviewer:** Do you communicate a lot with your experimental partner?
**Student:** It's quite a lot. We exchange our ideas of division of labour.
**Interviewer:** Was it in Chinese or English when you communicating with each other?
**Student:** Most of the time we use Chinese, sometimes in English.
**Interviewer:** Under what circumstances is English used?
**Student:** The names of some compounds, because we do not understand them in Chinese anyway, so we use English.
**Interviewer:** Are they newly leant compounds?

[5] When interacting with staff in the laboratory in the UK, which language do you use? Mostly Chinese with some English (7.7%), Mostly English with some Chinese (61.5%), Chinese only (0%), English only (30.8%); n = 13.
[6] How much interaction occurs between you and staff during a typical laboratory session in the UK? A lot (1), some (2), not much (3), none (4); mean 2.00; n = 13; SD 0.816.

**Student:** Yes, newly learnt.

The TNE-students had mixed views over how useful their interactions with other laboratory users were in terms of learning practical chemistry techniques. Interactions with other TNE-students, UK-based staff, the TAs and technicians were all seen to be useful as shown by statistical analysis of the questionnaire data.[7, 8, 9] Interactions with the UK-based students were only seen as "quite" useful[10] and did not occur regularly.[3]

## Discussion

TNE-students working in UK teaching laboratories for the first time face a number of challenges. Their interaction with the UK-based cohort has been studied through analysis of TNE-students' reported experiences and perceptions using questionnaire data and individual interviews.

A very real obstacle limiting interaction between the TNE-students with other laboratory users is the high stakes of the assessment linked to successful completion of the experiments. The advanced practical course is a 20 credit Level 6 module, assessed entirely on the basis of laboratory reports and reaction outcomes. As noted earlier, the TNE-students perceive the main goal of the laboratory work as gaining associated credit; English language improvement, gained by communicating with other laboratory users, is secondary. In addition, the TNE-students acknowledge that the UK students are also working to obtain a good mark and that by conversing with and requesting help from the UK students they may be slowing them down and causing them to sacrifice credit. This is likely compounded by the limited English language skills of the TNE-students, resulting in prolonged oral interactions as both groups of students strive to make themselves understood. Without considerable adjustments to assessment design to lower the perceived and real risk of impact to credit outcomes, it is difficult for chemistry educators to rationalise 'engineering' greater cross-national grouping within laboratory sessions.

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[7] How useful do you feel interacting with the technician/demonstrator is for your learning? Very (1), fairly (2), quite (3), not very (4); mean 1.69; n =13; SD 0.751

[8] How useful do you feel interacting with the lecturer is for your learning? Very (1), fairly (2), quite (3), not very (4); mean 1.77; n = 13; SD 0.599.

[9] How useful do you feel interacting with your [TNE]-classmates is for your learning? Very (1), fairly (2), quite (3), not very (4); mean 1.85; n = 13; SD 0.555.

[10] How useful do you feel interacting with your British classmates is for your learning? Very (1), fairly (2), quite (3), not very (4); mean 3.23; n = 13; SD 0.832.

Despite the unfamiliar physical environment and differences in working practices, there is a desire from the TNE-students to interact with the UK-based students. We believe that another major barrier to achieving successful interaction and integration was instigated in the first laboratory session that students attended, where they were divided into pairs. Integration between cohorts was not encouraged (i.e. by mixed-cohort pairings) and may have actually encouraged the lack of interaction over the course because there was little impetus for students to interact.

A final substantial challenge stems from the TNE-students' perceived competence in using the English language. Although all students have to meet the university's required IELTS grades in English for enrolment, this is not necessarily adequate to prepare them to fully communicate with other laboratory occupants as it does not measure discipline-specific language and literacy. Results from the questionnaires, interviews and observations show that after transfer to the UK the TNE-students tend to rely on each other rather than an academic member of staff or other laboratory occupants. This is because they find it easier to communicate in Chinese rather than English due to lack of confidence in English language, the speed of discourse they encounter, and the subject-specific vocabulary required. Other challenges to interaction between the TNE-students with other laboratory users identified include: the laboratory environment being very loud so hearing and explaining issues is difficult, the fast pace at which interactions with other interlocuters occur, and the high-stakes credit linked to the assessment of the practical work completed. It is possible that because all laboratory users are under pressure to complete the experiments and gain academic credit, there may be lower tolerance towards less-proficient English language users and *vice versa*, however this was not investigated further.

**Impact on student learning**

The TNE-students' lack of confidence in technical, subject-specific language upon transfer to the UK has been shown to be a barrier for student interaction, and therefore student integration, in practical classes. Limited levels of integration and interaction during lectures or other teaching events will also undoubtedly have an impact upon student learning and could lead to a lack of understanding of a topic with a resulting impact upon student attainment. The risk is intensified for these students as they transfer to the UK for their final year of study, which is particularly demanding and contributes a large proportion towards the final degree grade outcome.

## Conclusion

There are a number of potential implications from the findings of this study. Language, namely knowledge of technical vocabulary and receptive difficulty with oral communication, was found to be a major barrier to interaction between, and therefore integration with, cohorts during laboratory work. This suggests that the way in which TNE-students are prepared for study in the UK should be reviewed. Despite the fact that the TNE-students are taught in English in China, there may be an argument for more intensive, discipline-specific vocabulary input and development of listening skills.

In order to ensure interaction, and subsequent integration, between student cohorts, mixed nationality pairings should be considered when designing laboratory or similar workshop activities. However, this is a sensitive and complex part of the programme structure, thus changes should be carefully considered. One possible way to facilitate greater interaction and subsequent integration between the two cultural groups might be to explore whether the principles of 'compassionate group work' could be applied to the laboratory setting. This technique was developed and embedded within assessment at the University of Hertfordshire by Gilbert (2016a, 2017) to promote diversity and inclusion. In this work, students' individual, observable demonstrations of compassion were credit-bearing in some modules. The rationale was that when people feel socially safe in task-focussed groups, their thinking processes are able to concentrate on task rather than on the evolutionarily determined priority of (social) defence mechanisms. Students were trained in compassion-based micro skills for task focussed, face-to-face student group work in a short workshop at the beginning of the module and then gave a seminar in which their compassion skills were assessed. It was shown that credit for compassionate behaviours appeared to positively motivate students to attempt compassionate group management, regardless of their ethnic or national status (Gilbert 2016b; Gilbert *et al.* 2018). It may be possible to adapt the original model as used for seminar work to the oral environment of the laboratory.

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## Disclosure statement

No potential conflict of interest was reported by the authors

## Ethics

Ethical approval was given for this study by the ethics committee in the International Study and Language Institute at the University of Reading.

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## Appendix 1

## Interview guide questions

### Areas to explore more:

Lab work in general:

- Were you told to do anything to prepare for labs in the UK?
- Benefits of working in pairs in the UK
- Would you prefer to be in [TNE] pair or UK and [TNE] pair? Explain
- Do you prefer asking Chinese/English staff for help?
- Lab follow-up in UK compared to [TNE]

Communication:

- If interaction is mainly with [TNE] students (in interviews) – why?
- Barriers to communication?
- What do you think the British students talk about in labs?

Lab work in UK?

- Benefits of UK labs?
- Challenges in UK lab sessions
- Is lab work different in the UK?
- How are your initial experiences?