HIGHER EDUCATION HORIZONS

Publishing Higher Degree Research

Making the Transition from Student to Researcher

Janice Orrell and David D. Curtis (Eds.)

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Publishing Higher Degree Research

HIGHER EDUCATION HORIZONS

Volume 1

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SENSE PUBLISHERS
ROTTERDAM/BOSTON/TAIPEI

A C.I.P. record for this book is available from the Library of Congress.

ISBN: 978-94-6300-670-5 (paperback)
ISBN: 978-94-6300-671-2 (hardback)
ISBN: 978-94-6300-672-9 (e-book)

Published by: Sense Publishers,
P.O. Box 21858,
3001 AW Rotterdam,
The Netherlands
https://www.sensepublishers.com/

All chapters in this book have undergone peer review.

Printed on acid-free paper

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JOY HIGGS

SERIES INTRODUCTION

Higher Education Horizons

This series explores the current volatile context of higher education and examines ways that the higher education sector is responding to and driving these changes. The books in this series tackle challenges facing the sector and question the goals and strategies that researchers, educators and theorists are creating to address these challenges. They explore trends in stakeholder expectations, and evolving pedagogies and different horizons existing and emerging in higher education. The authors in this series bring a wealth of academic practice wisdom and experience to examine these issues. They share their practice knowledge, report research into strategies that address these challenges, and raise yet more questions. Through the conversations in this book readers can enter into the debates, visions and experiences of the agents of higher education.

Joy Higgs
The Education For Practice Institute

PREFACE

This book is the product of research in a School of Education that has well over 100 higher degree research students with highly diverse ethnic and cultural origins. The research found that graduates are catalysts for further students from their region to join the School to take up higher degree research, and that despite participating in interpersonal and intellectual engagement in regular seminars with other students and academic staff, many international students returned home never to publish their work. Each new wave of students often posed research questions similar to those already addressed by previous students, with little opportunity to build on this prior research merely because it had not been published beyond the thesis.

In recognition of this gap in practice, all recent graduates and current higher degree students were invited to submit a chapter on some aspect of their higher degree research, with their supervisors as co-authors. At the same time, they were invited to reflect on the process of becoming a published researcher and what it meant for them. A core sentiment is captured at the beginning of each chapter and the students' extended reflections form the basis of an exploration of the transition from student to researcher through publication of their chapter.

This book serves two distinct purposes. First, it gives higher degree research students and graduates an opportunity to present their research as a succinct chapter – a form quite different from the thesis they have written or are writing. It gives them an audience and presents their work to that audience in a more readily accessible form. The act of publication poses new challenges for the authors. Yet again, they must interact with their supervisors as mentors and co-authors, and make decisions about aspects of their research that warrant attention. Inevitably, this means omitting issues that have been important aspects of their thinking – yet another phase of challenge in their emergence as researchers. Second, the book gives editors and readers an opportunity to reflect on the transition from higher degree research student to researcher, and examine the pedagogy of higher degree research supervision. By exploring the transition, we reflect on the "product" – the accomplished graduate – as well as the process, and ask what we can do to facilitate the transition, and how we can do that most effectively and efficiently.

The first two chapters argue that adopting the notion of higher degrees as research training requires a new pedagogy of higher degree supervision. They seek to locate publication by higher degree students within the program to ensure that higher degree research, in addition to generating new knowledge and new insights, develops a wide range of high-level skills that graduates subsequently apply in the roles they pursue after graduation. Joy Higgs draws attention to the critical role of writing as an act of exploration and the vehicle through which findings are shared with a community of scholars for information and critique. She locates higher degree research as research training designed to prepare graduates for "…future complex and unpredictable situations". This preparation requires a model of mentoring that "liberates" students in their journeys from novice and dependent to accomplished and independent researchers.

The transition from graduate student to independent researcher entails change along several dimensions, which Orrell and Curtis track through an analysis of higher degree research students' and graduates' reflections on their research journeys; journeys that challenge individuals' self-concepts and identities. New identities and new conceptions of self emerge. A common experience is commencement of a higher degree research program with a clear objective driven by a strong personal commitment to improvement and an expectation of pursuing a particular line of investigation. Challenges arise as students interact with their supervisors and the literature of their chosen fields. They are encouraged to reconceptualise the issue they have chosen to investigate; a process requiring self-reflection and evaluation, and taking a critical stance in relation to the literature and their own conceptions of their chosen area of research.

These two introductory chapters provide an understanding of the context for the production of the next 14 chapters, which are testament to the students' transition process. Chapters 3-5, which explore "Learning with technology", locate different technologies in the values and requirements of the groups with which they are used rather than with their characteristics. Chapters 6-9, addressing "Professional learning and practice", illustrate that despite research contexts as diverse as rural teaching in Lesotho and skills development for mining technicians, professional learning has common drivers. Dialogue features prominently, as do commitment to learning and the impact of policy on formal training. In chapters 10-12, which explore "Student learning", the variety of different perspectives about what factors influence learning – from language learning strategies to problem solving theories to the affective dimensions of learning – emphasise the individuality of the learning process. The final section, "Curriculum change", demonstrates innovation as a characteristic of developing education systems. Chapters 13-16 explore attempts to improve curricula in diverse settings in Indonesia and Rwanda. An initiative to improve prospective teachers' English language skills as a way of improving the quality of teaching Mathematics and Science in English is investigated. The importance of generic skills and competence, balanced with local requirements, is discussed in terms of educational quality improvement, while working with, and around, government-decreed curriculum innovation is also examined.

We commend the contributions of the authors to future researchers in the expectation that future research will build on the findings reported here. The breadth of the research represents the diverse concerns of researchers who have embarked on a higher degree research journey with the aim of improving education delivery and outcomes through investigating and understanding everyday practice issues.

Janice Orrell and David D. Curtis

ACKNOWLEDGEMENTS

We wish to thank those who provided considerable support in compiling this volume and bringing it to completion. We express our appreciation for the support provided by Associate Professor Helen Askell-Williams as the Head of Flinders Educational Futures Research Institute (FEFRI) in securing Faculty funding to assist with this venture, and Marja van Breda, the Institute's Research Administration Officer, for her ongoing project management. We are deeply indebted to Professor Joy Higgs, Series Editor and Co-Director, Strategic Development, The Education For Practice Institute (EFPI) at Charles Sturt University, for including this volume in her series. We also greatly appreciate her encouragement and wise counsel. We thank Ros Allum, Project Officer at EFPI, for her ongoing advice and willingness to share her expert opinion on the publication process. We pay our respect and thanks to our colleagues, Flinders University, and School of Education academics and higher degree scholars who have collaborated to contribute to this volume. We especially commend the higher degree candidates and graduates for their willingness to share their work and their personal reflections regarding the higher degree research journey. We also wish to express our gratitude to Margaret Bowden, our editorial assistant, who is indeed an editor's editor, without whose diligence and commitment to attending to detail this publication would not have been possible.

Thank you to Matthew Kearney for permission to use one of his diagrams from Kearnery, Schuck, Burden and Aubusson, (2012) and to Doris Bergen and Routledge Publishers for permission to use her *Schema for play and learning* and five play types (Bergen, 1998, 2006).

Finally, we are deeply appreciative of the support provided by the chapter reviewers for their critical reflections and constructive suggestions for each chapter. The reviewers were Helen Askell-Williams, Michael Bell, Denise Chalmers, David D. Curtis, Kym Fraser, Deanne Gannaway, David Green, R. John Halsey, Joy Higgs, Dianne Korare, Mike Lawson, Betty Leask, Bernard Mageean, Janice Orrell, Lee Partridge, Beverly Rogers, Robin Ryan, Katharine Swain, Trudy-Ann Sweeney, Faith Trent, Mirella Wyra, Gerald White, Peter Willis and Penny Van Deur.

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SECTION 5: CURRICULUM CHANGE

SONI MIRIZON, BEN WADHAM AND DAVID D. CURTIS

13. TEACHING MATHEMATICS AND SCIENCE IN ENGLISH AT A UNIVERSITY IN INDONESIA

Lecturers' and Students' Attitudes to the Initiative

> This chapter reflects a doctoral candidate's process of scientific thinking and acting, not merely a matter of completing the thesis, but as a pathway from scholarship and practice to researcher. (Mirizon)

Indonesia is a multicultural country consisting of approximately 300 ethnic groups and a multilingual society having as many as 700 local languages. However, this diverse country shares one national language, Bahasa Indonesia, which functions as the *lingua franca*. Accordingly, Bahasa Indonesia has been used as the language of instruction at all levels of education across the nation since its independence from the Dutch in 1945.

In 2007, through the establishment of international standard schools (Sekolah Berstandar Internasional, SBI) under Law No.20/2003, the Indonesian Government introduced a policy of using English as a language of instruction for Mathematics and Science. Other subjects are taught in Bahasa Indonesia.

Globalisation is the stated rationale for establishing SBI because it "is perceived as being synonymous with international competition; international competition in turn is assumed to involve the use of English; and using English appears to necessitate the learning of other subjects through English" (Coleman, 2009a, p. 5). Teaching Mathematics and Science in English is important for at least two reasons. First, Indonesia has to be able to develop strong human resources in a relatively short period of time. Second, students must be able to use English to communicate globally because English is an international language (Department of National Education, 2004).

In order to be fully operational, SBI urgently need Mathematics and Science teachers who are competent in their Content Knowledge and proficient in English. However, there is a nationwide shortage of available in-service teachers who meet these criteria (Coleman, 2009b). Accordingly, teacher education institutions began pre-service training in 2008 to address this need through the International Standard School Teacher Education (ISSTE) program, which was established in one of the teacher education institutions. The ISSTE offers four study programs – Mathematics Education, Chemistry Education, Biology Education and Physics Education – to prepare teachers to deliver integrated content-based instruction (CBI) in SBI. Implementing CBI requires teachers who are content area specialists,

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and proficient in English and the practice of CBI. These skills are developed through ISSTE programs like the one discussed in this chapter.

The study reported here examined lecturers' and students' attitudes towards implementation of a policy of integrating the teaching of Mathematics and Science with English in an ISSTE program in a university in Indonesia (Mirizon, 2014). It evaluates those attitudes and relates them to the lecturers' and students' English language proficiency.

LITERATURE REVIEW

Integrated content and language instruction, commonly known as content-based instruction (CBI), is the practice of the integrated teaching of academic subject matter and second language skills. This practice focuses not only on the instruction of language but also on integrating it with content, which usually comprises academic subject matter (Brinton et al., 2011). For students, the focus is on acquiring information (content) via the second language and on developing their academic language skills in the process.

The benefits of CBI have become apparent over recent years. This method of instruction has been acknowledged as fostering academic growth while developing language proficiency (Crandall, 1993; Short, 1997; Snow, 1998; Stoller, 2004). Indeed, it is beneficial because "classroom tasks provide a context for language learning, are more cognitively demanding, and reinforce the existing school curriculum" (Pessoa et al., 2007, p. 103).

Although CBI was initially introduced in an English as a second language (ESL) context, it has been implemented in English as a foreign language (EFL) contexts (Butler, 2005). A number of studies explore the implementation of CBI in various EFL contexts, such as Spain, USA, Taiwan, China, South Korea and Japan (Boswell, 2011; Butler, 2005; Cammarata, 2009; Liaw, 2007; Okazaki, 1997; Pessoa et al., 2007; Willis, 1998). These studies acknowledge the benefits of CBI for integrating content and language instruction. This study occurred in the Indonesian EFL context.

THE STUDY DESIGN

The study design reflected the research aim of answering the questions: (1) what are the lecturers' and students' attitudes towards the implementation of integrating the teaching of Mathematics and Science with English policy?; and (2) what are the underlying reasons for the attitudes the lecturers and students show? These are the questions addressed in this chapter.

The study employed a mixed methods approach combining quantitative and qualitative data collection and analysis (Teddlie & Tashakkori, 2009). A survey of lecturers and students in the ISSTE program produced the quantitative data, while interviews with the lecturers and focus group discussions with the students generated the qualitative data. Classroom observations of teaching and learning practices supplemented these data collection methods. Survey data was analysed

using SPSS (2014), while the data obtained via interviews and focus group discussions was subject to thematic analysis (Babbie, 2010; Rivas, 2012; Silverman, 2011; Strauss & Corbin, 1998). The findings arising from both approaches were integrated and interpreted to draw conclusions.

Participants comprised 20 lecturers and 373 students for the survey, and 12 lecturers for the interviews and 20 students for focus group discussions who were selected purposively. All participated voluntarily. The lecturers represented the four study programs (Mathematics Education, Chemistry Education, Biology Education and Physics Education), and each had more than ten years' teaching experience. The students had studied in the ISSTE program for more than two semesters.

FINDINGS

Lecturers' Attitudes towards CBI

The findings revealed positive attitudes towards integrated Mathematics and Science teaching in English among lecturers who are proficient in English, while those with limited English proficiency had negative attitudes. Analysis of the survey and interview data revealed two key findings related to the lecturers' positive attitudes towards the integrated teaching of Mathematics and Science in English: (1) lecturers believed that teaching Mathematics and Science in English prepares students for the globalised job market; and (2) they expected favourable employment outcomes for graduates.

Most lecturers were aware of the importance of English for their students' futures. Thus, they had positive thoughts regarding the policy of teaching Mathematics and Science in English. They expected that, apart from Content Knowledge mastery, teaching Mathematics and Science in English would provide their students with an opportunity to master a foreign language, which would help prepare graduates for the globalised job market, as illustrated by Participant 8:

> The teaching of Mathematics and Science in this ISSTE program, as far as I know, is to prepare graduates to have not only content competence but also foreign language competence, like English, that is needed in the globalised job market …

This lecturer also believed that teaching content in English motivated students to improve their English skills because they expected these skills to lead to favourable employment. Motivation occurs when students feel challenged and realise the importance of English for their future employment:

> Teaching Mathematics in English has a positive effect on students; students are motivated to equip themselves with English skills to get a favourable job and career relatively easily. Those with limited English were later motivated and those who already had English skills became more motivated. This policy gave students a chance to study and improve their English … (Participant 8)

Conversely, data from the survey and interviews revealed two key findings related to the lecturers' negative attitudes towards implementation of the policy of integrated teaching of Mathematics and Science in English: (1) Limited English proficiency; and (2) low willingness to learn content in English. Some lecturers argued that the CBI policy had placed them in a difficult position due to their limited English proficiency. This, in turn, generated a negative influence on students who had limited facility in English. Having limited English proficiency made it difficult for lecturers to explain subject matter in English and to enable students to understand the content taught using English:

> Making students understand teaching materials taught in English is difficult; even in Bahasa Indonesia it is not easy, more so in English … sometimes they don't understand … because my English is not that good, I prefer using Bahasa Indonesia more so that students can understand … also to avoid misunderstanding … (Participant 5)

Apart from their own limited English proficiency, lecturers found their students' limited English proficiency another common obstacle. Most students' proficiency in English was very limited. Based on the data obtained from the university's language institute, the students had an average paper-based TOEFL score of around 380–450.[i] Lecturers' concerns about students' limited English proficiency is reflected in the following comment:

> … students' limited English competence is the most serious problem I face. If their English is good, it would be really helpful … but you know, they are not ready to study Biology in English although they have good intellectual competence. I cannot take a risk using English all the time in teaching … (Participant 3)

Although lecturers attempted to improve their own English proficiency, for instance by joining language classes provided at the university language institute or undertaking self-directed study, they admitted that it did not help much because they would need a long time to become proficient in English. Survey results indicate that most lecturers rated their English proficiency as "high intermediate", some thought their English was "intermediate" and only a few rated their English as "advanced". This range of English proficiency among lecturers was expected because Bahasa was the only language of instruction throughout their primary to undergraduate studies. Only those who had pursued a Master's or Doctoral degree overseas would have experienced English as the language of instruction. Thus, when some lecturers were asked to teach Mathematics and Science in English, they realised they were constrained by their limited English proficiency. One of the participants confessed:

> The biggest problem for me is my own ability to teach Physics in English. My English competence is still limited, so I mostly use Bahasa Indonesia for explaining and communicating with students; only the teaching materials, such as handouts and PowerPoint, are in English … (Participant 11)

Seemingly, it was those lecturers with limited English proficiency who reported a low level of student readiness to learn content in English; this certainly relates to the students' limited English proficiency. On average, students' passive English mastery (such as for reading texts) was just sufficient, but the active level needed to communicate and carry out scientific class discussion was still problematic. This issue is one of the problems that lecturers encounter when teaching in English. The following excerpt from an interview with Participant 1 shows evidence of this phenomenon:

> The biggest problem I face is the students' readiness to study in the ISSTE program … because their English is not sufficient enough to support them in the program. But not for reading, it is ok. To use academic English actively, such as discussing a lesson in English in the class, is not working … (Participant 1)

Students' Attitudes towards CBI

Analysis of the survey and focus group discussion data revealed two key findings related to students' attitudes towards the implementation of integrated teaching of Mathematics and Science in English: (1) students believed that learning Mathematics and Science in English prepared them for a globalised job market; and (2) it prepared them to pursue postgraduate study.

Students of Mathematics and Science showed a positive attitude towards the practice of learning content in English because it prepared them for a globalised job market. While they believed that the Indonesian language was better for studying Mathematics and Science, students recognised the importance of English in a globalised job market. This position is illustrated by a response from one focus group participant:

> … learning Physics in English provides us with an opportunity to improve and be proficient in English. Having good mastery in English makes us able to communicate in international communication. This skill is required in taking part in the global market. Before we start working we would need to be skilful both in our Content Knowledge and English … (Participant 4, Focus Group 3)

Furthermore, students believed teaching content in English equipped them with English skills for pursuing higher degrees, an ambition that many students shared. This viewpoint is revealed in the responses given by several students:

> … English has become the demand to pursue higher education such as a master's degree. It's better if, from undergraduate degree, we are accustomed to using English though we believe it is not easy … so, when we want to continue our studies, we are ready … (Participant 2, Focus Group 2)

This comment reflects the view that mastery of English is required to pursue postgraduate study. Therefore, developing proficiency in English during undergraduate study should be encouraged.

Participants in other student focus groups made similar comments, while many of the comments provided in the survey responses also indicate that students' reasons for choosing the ISSTE program included a desire to develop mastery in Content Knowledge and to be proficient in English. They believed that these dual competences were useful for their futures, including the opportunity to pursue postgraduate study. The following excerpts are examples taken from a teaching and learning activity in a Biology class the researcher observed. The lecturer applied a group discussion technique in teaching the Animal Structure subject, focusing on the topic "Terrestrial animal respiration". Each group was asked to discuss its assigned task and present it to the class. When all the groups presented their tasks explaining "Terrestrial animal respiration", most of the group spokespersons resorted to using Bahasa Indonesia, not English as was required:

> … we are from group one … er… er … we want to explain about the respiratory of worm …, but … we are not going to use English … er … er … but Bahasa … it's not easy, you know … er … er … to explain this in English. *Pernafasan cacing dilakukan dengan* (the respiratory system of worm) … (Student presentation, Group 1)

The above quote is just one example of the student presentations. Only one of the six participating groups managed to present their information in English. During group discussions before their presentations, most students did not seem to have significant problems understanding the texts written in English. However, they experienced difficulty using English to communicate the content of the texts to their classmates and lecturers during class discussion.

The results indicate that most of the students opposed the policy of integrating the teaching of Mathematics and Science in English. They found it hard to understand content taught in English due to their limited English proficiency. Although some possessed good English mastery, they were very much a minority. This is consistent with data obtained from the university language institute, where most students were at the pre-intermediate to intermediate level of English proficiency. The demographic data obtained with the survey showed that most students rated their English proficiency as pre-intermediate, some rated it at elementary level, and a few saw themselves as having a postintermediate or advanced level of English:

> In my case, the problem that I face is mastering Biology teaching materials in English. (Participant 4, Focus Group 3)

When students were asked further questions related to which area of English they found difficult, most had encountered difficulties related to discourse and sentence levels. At the discourse level, students were constrained in understanding and producing lengthy spoken or written information, while at the sentence level they were sometimes limited in understanding and using complicated grammatical structures in sentences.

Concord in Lecturer and Student Views

Despite some disagreement in attitudes towards the policy of integrated teaching of Mathematics and Science in English, lecturers and students shared the similar view that good English proficiency is required to learn Mathematics and Science content in English and to teach that content in English. Lecturers believed that good English competence was what students needed to learn content in English. Indeed, good English competence enables students to follow lessons and access content from many sources written in English, as illustrated in the following interview excerpt:

> I definitely agree that good English competence is what students need if they want to learn Chemistry in English. Without having this ability, it will be difficult for them to understand the content taught … (Participant 5)

Participants also shared the belief that limited English competence is a barrier to student learning, preventing them from making progress. Instead of feeling empowered and challenged by learning two subjects at the same time, students with limited English proficiency would see it as a burden. In this case, lecturers thought that teaching content in English inhibited student learning, as indicated by the following excerpt:

> I believe that teaching Mathematics and Science in English is not easy for students who have limited English. They would find it hard to understand content taught in English … (Participant 3)

The survey data demonstrated that students' linguistic competence in Bahasa Indonesia is significantly better than that of English. Hence, it is reasonable that students prefer learning content in Bahasa rather than in English, because good English proficiency is required in order to successfully learn content in English. Students also realised that integrated teaching of Mathematics and Science in English would open their mind about the importance of English for acquiring Content Knowledge. They were aware that good English proficiency was required to learn Mathematics and Science in English, as indicated in the following focus group discussion response:

> … nowadays English is not something "special" anymore, but a need. Being proficient in English is necessary when we learn Mathematics and Science in English … (Participant 2, Focus Group 3)

These excerpts illustrate an awareness that having sufficient English knowledge is required to understand and master Content Knowledge taught in English. The students realised that good mastery of English not only gives them the benefits of being able to comprehend course content, but it can also be used as a means of pursuing knowledge for their own benefit.

CONCLUSION AND IMPLICATIONS

The aim of this study was to examine lecturers' and students' attitudes towards the implementation of a policy of integrating the teaching Mathematics and Science with English in a university in Indonesia. It evaluated those attitudes and related them to the English language proficiency of the lecturers and students.

Findings obtained from questionnaires and interviews reveal positive attitudes towards the integrated Mathematics and Science teaching in English among those lecturers who are proficient in English while negative attitudes are found among those with limited English proficiency. Findings obtained from questionnaire and focus group discussion with students show similar results. Students who have good English proficiency reveal positive attitudes towards the use of English in teaching Mathematics and Science, whereas those with limited English proficiency show opposing attitudes. However, both lecturers and students share a similar view that good English proficiency is required to learn Mathematics and Science content in English and to teach that content in English.

The findings of this study indicate that effective implementation of integrated content and language instruction in tertiary education requires comprehensive and careful planning and preparation that embraces proficiency in English by lecturers and students, and specific professional learning by lecturers about CBI methods. Encouraging positive attitudes towards integrated Mathematics and Science teaching in English among all lecturers and students rests with strategies to raise their English proficiency levels. The link between attitude towards integrated Mathematics and Science teaching in English and level of English proficiency provides the basis from which to start improving proficiency levels. The fact that both lecturers and students shared the view that good English proficiency is required to learn Mathematics and Science content in English, and to teach that content in English, means that the task of raising English proficiency should be attainable. However, students who struggled to learn Mathematics and Science in English expected lecturers to emphasise the content, and to give proportional attention to both conversational and academic English, with a greater focus on the latter. Proportional attention given to both content and language (English) is the core principle of integrated content and language instruction, where students learn the language used in the context of the content taught, not as a separate subject. Unfortunately, the study's findings indicate that such attention was rarely paid as a result of some lecturers' limited English proficiency. Conversely, even if the lecturers' English proficiency was very good, some students' proficiency was lacking. Therefore, both lecturers and students need a competent level of English proficiency for the integrated learning of Mathematics and Science in English to succeed. English competence alone, however, will not solve the issues of integration. Lecturers must be knowledgeable about integrated content and language instruction (CBI) in order to deliver the information in ways the students can understand. Indeed, this study suggests that lecturers should be well trained in the effective implementation of integrated content and language instruction in addition to being proficient in English.

A Postscript to the Study

In 2013, and as the current study drew to a close, the Indonesian Central Government revoked the SBI policy after it had been in operation for six years. This decision, however, does not render the ISSTE program irrelevant. Many private primary and secondary schools across Indonesia continue to offer bilingual education that applies integrated content and language instruction. Moreover, this approach is gaining attention in many tertiary education programs in Indonesia. In short, content-specialist teachers who are also proficient in English are in demand to meet the needs of these CBI programs.

NOTE

[i] The minimum accepted TOEFL score for admission to an Australian university is 550.

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