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Integrated Content and Language Instruction: Lecturers' Views and Classroom Instructional Practices

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Abstract: The objective of this study was to investigate how integrated content and language instruction, where English is used as the medium of instruction in teaching Mathematics and Science was viewed by the lecturers of the content subjects. The study also examined whether or not it had impacts on the lecturers classroom instructional practices. Cummins' (1981, 1984) Content Based Instruction approach was used as the framework for the study. This study employed a mixed methods approach combining interview, classroom observation, and a survey questionnaire. Twelve lecturers participated in interviews; twenty responded to a survey questionnaire, and four participated in classroom observations. Findings of the study revealed that most lecturers viewed positively the integrated content and language instruction. This view had impacts on their classroom practices where modifications were made in order to accommodate the implementation of the policy. This study provides information for policy makers, teacher educators, and content teachers to understand how the policy is articulated and how it is implemented in the Indonesian teaching context.

Introduction

Indonesia's central government has determined that it must improve the quality of education in order to produce competent and skilful graduates who are able to compete in a globalised world. Accordingly, the government has implemented a number of programs to improve the Indonesian educational system. One such program is the establishment of International Standard Schools [*Sekolah Berstandar Internasional*, SBI]. Through SBI, the Indonesian government tries to build schools that are able to foster the advancement of Indonesian education. This was mandated in two legislative instruments (Law No.20/2003 and Decree No.19/2005, Government of Republic Indonesia, 2003 and 2005). These instruments authorise central and regional governments to establish at least one primary and one secondary school per district that could become SBI schools. At SBI schools, English has been endorsed as the medium of instruction for content subjects, primarily Mathematics and Science.

SBI schools require qualified teachers who are competent in their content subject and proficient in English, and know how to teach it. However, in-service teachers who fulfil these criteria are scarce in Indonesia (Coleman, 2009). Because of the urgent need for these dual-qualified teachers in SBI schools, much training for in-service teachers has been conducted by the government since 2007, but the initiative has had limited impact because of the great

number of teachers who need this professional learning. In addition, preparing in-service teachers to be skilful in both content subject and English has long lead times but this approach is necessary in order to meet the demand for qualified teachers for SBI schools. From 2008, a number of teacher education institutions took the initiative to respond to this demand.

In 2009, the International Standard School Teacher Education (ISSTE) program was established in an Indonesian university to fulfil the need for English-proficient content subject teachers. It prepared pre-service teachers for teaching Mathematics, Chemistry, Biology, and Physics education. In its initial implementation, this program was embedded in the mainstream program—Mathematics and Science Education Department, Faculty of Education—where most subjects were taught in Bahasa. During this time, only limited subjects were also taught in English in the ISSTE program. In 2013 the ISSTE program operated separately from the mainstream program and in the ISSTE program, all subjects were taught in English. Lecturers of Mathematics and Science Education were involved teaching in both mainstream (Bahasa) and the ISSTE (English) programs.

This article reports on a study investigating the implementation of Mathematics and Science instruction in English in a university in Indonesia. Specifically, it evaluates the lecturers' insights towards the policy and its impacts on their classroom instructional practices. In this paper, we review literatures related to CBI and its framework proposed by Cummins (1981), describe the methods used in the study, present findings and discussion, and we draw conclusions and implications.

Literature Review

The integration of teaching content subjects and a second or a foreign language has been practiced for the last twenty five years (Grabe & Stoller, 1997). It has become a contemporary model that differs from many existing methods which separate language learning from content learning (Barwell, 2005; Marsh, 2008; Snow, Met & Genesee, 1989). The focus for students is on acquiring subject-matter information via the second or foreign language and on developing their academic language skills in the process. The goal of this integrated learning is to enable students to transfer their language skills to other academic courses taught in the second or foreign language. This approach has been shown to promote academic growth and upgrade language proficiency simultaneously (Crandall, 1993; Short 1997; Snow, 1998; Stoller, 2004). In this case, the second or foreign language—English—is used as a medium to understand content and in return, subject content functions as a source for acquiring the language (Eurydice, 2006; Stoller, 2002). This integrated approach is known as content based instruction (CBI).

CBI has been practiced in both English as a second language (ESL) and foreign language (EFL) contexts, in various forms across educational settings (Cummins, 1984; Boswell, 2011; Butler, 2005; Cammarata, 2009; Liaw, 2007; Okazaki, 1997; Pessoa et al., 2007; Tan, 2009; Willis, 1998). It has also been given various names such as language across the curriculum, language for specific purposes (LSP), and immersion.

A similar instructional approach, one of the most rapidly increasing approaches to this kind of endeavour and that has come to dominate in recent years in the European context is *content and language integrated learning* (CLIL) (Marsh, 2002). This approach is a blend of both language teaching and content teaching, as opposed to a separation of each (Marsh, 2008). Coyle, Hood, and Marsh (2010, p. 1) describe CLIL as "a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language. That is, in the teaching and learning process, there is a focus not only

on content, and not only on language. Each is interwoven, even if the emphasis is greater on one or the other at a given time". CLIL is implemented in contexts where an additional language (not the predominantly used language of the context) is used for teaching and learning content or school subjects other than the language itself (Marsh & Lange, 1999). CLIL has been adapted in various forms within and across countries, indicated by diversities in terms of curricula, targeted content area, selected languages, selected students, materials, teaching methodology, assessment, and teacher training (Marsh, Maljers & Hartiala, 2001).

If both definitions are examined, CBI and CLIL essentially refer to a dual-focused educational approach where a second or foreign language is used as a medium of instruction to learn content and the content is used as a motivator to facilitate second or foreign language acquisition (Coyle, Hood & Marsh, 2010; Dalton-Puffer, 2007).

Integrated content and language instruction has been conceptualised as a continuum ranging from contextualised language teaching to language-conscious content teaching where immersion is placed at the more subject-focused end, while theme-based instruction in more language focused end (Davison & Williams, 2001, p.100), as illustrated in Figure 1. Immersion emphasises a commitment to content-learning objectives while theme-based instruction displays stronger commitment to language-learning objectives.

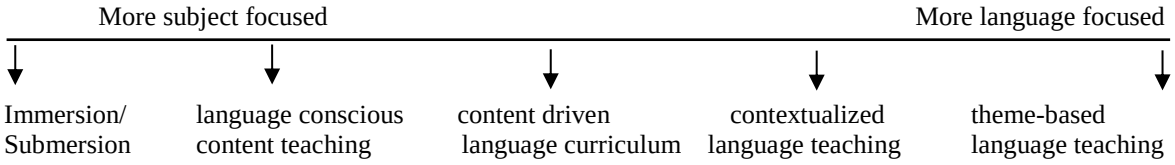

Figure 1: The continuum from more subject focused to more language focused curriculum (Davison & Williams, 2001, p. 100)

The form of content-based instruction implemented in SBIs is 'language conscious content teaching' since the focus is on teaching content through English but not at the expense of English teaching. In other words, a content teacher uses a foreign language (English) to teach content courses (Mathematics and Science) to a group of learners. In this model, learners are placed in the same linguistic boat, where they benefit from the teacher's use of language instruction which sometimes contains adjustments and simplifications. This model assumes that a school has teaching staff who are proficient in English and in their subject content areas. Wherever the teacher's focus lies on the continuum of content and language integration, as learners study content in a second or foreign language, they naturally require extensive support in comprehending academic texts in the second or foreign language and in utilising the language related to the content (Larsen-Freeman & Anderson, 2011).

The relationship between content and language has become the primary concern in most forms of integrated content and language instruction (Snow, 1998). It is characterised by a tension between the areas of content and language related to the primacy of one aspect over the other. It is believed that the use of a foreign language, in which learners may have poor proficiency, will inhibit subject matter learning. Conversely, learners with weak subject matter knowledge may not have sufficient conceptual knowledge in the content domain to be able to infer meaning expressed in the second or foreign language. Such a conflict can be resolved if teachers are competent in both content and language fields (Dalton-Puffer, 2007). Being qualified in both areas, teachers are expected to focus on both content and language instruction unless the curriculum focuses on one aspect or the other. If the curriculum is more focused on one side of the continuum, teachers need to demonstrate whether they are more subject-focused or more language-focused in the instruction (Snow, 1998). Since SBIs adopts 'language conscious content teaching', teachers need to be more subject-focused.

The notion of cognitive demand and decontextualised language (Cummins, 1984) is the key considerations in the development of integrated content and language instruction (Heo, 2006; Liaw, 2007). Cummins (1984) proposed that language proficiency can be conceptualised along two continuums. In this framework, Cummins proposed the linguistic requirements necessary for an English language learner (ELL) to succeed in academic life.

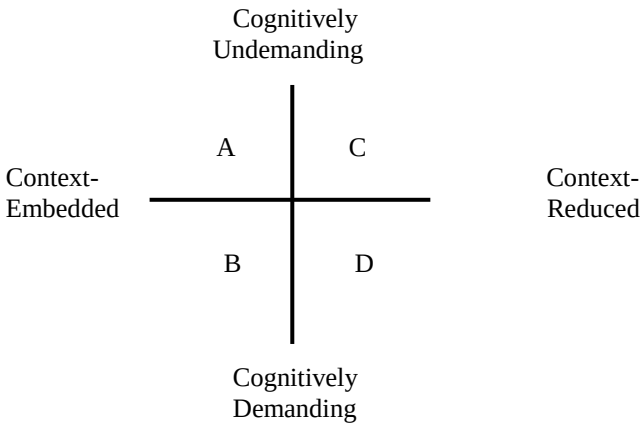

Figure 2: Range of contextual support and degree of cognitive involvement in communicative activities (Cummins, 1984, p. 139)

The first continuum is related to the extent of contextual support for conveying or grasping meaning in communicative activities. This continuum is described in terms of "*context-embedded*" versus "*context-reduced*" communication (horizontal continuum). The other continuum is associated with the extent of intellectual or cognitive complexity demanded in communicative activities; it is illustrated in terms of "*cognitively undemanding*" versus "*cognitively demanding*" (vertical continuum).

In quadrant A, an ELL deals with the target language in a context that provides cues and that imposes a low cognitive load and is therefore easy to learn. It resembles everyday communication outside the classroom context where a low degree of cognitive demand is required. Contextual supports such as feedback, paralinguistic and situational cues are usually available for ELLs to understand the message conveyed. In this case, ELLs are exposed to topics they are familiar with or recognise. In quadrant D, an ELL encounters the language that is more demanding and more difficult to acquire. It is typically the language used inside the classroom where a high cognitive load is imposed and contextual supports are not readily available. ELLs are introduced to topics that are complex and require abstract thought. Successfully understanding the message conveyed depends heavily on the ELLs' knowledge of the target language. In quadrants B and C, an ELL deals with the target language in between quadrants A and B. In quadrant C, the amount of context-embeddedness is reduced but the cognitive demand is low. In this state, an ELL encounters easy topics with which they are familiar. In quadrant B, the amount of context-embeddedness is high but the cognitive demand of the content increases. At this point, an ELL faces more difficult topics which require more demanding language proficiency. We would expect that having high contextual embeddedness would help the ELL because the context will provide clues about the meaning of the language and thereby moderate the effect of cognitive demand. Conversely, low contextual embeddedness would leave the ELL with few clues which would make understanding meaning more difficult. In SBIs, we suggest that the cognitive load of the subject content is high as new concepts and new specialised terms are introduced. However, with teachers who are proficient in the target language and who have the pedagogical

knowledge to teach the language, we expect the SBI or ISSTE context to reflect Quadrant B in the Cummins' framework.

According to Cummins and Swain (1986), "[t]his framework [is an attempt] to integrate an earlier distinction between Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP) into a more general theoretical model" (p. 152). Cummins (1981) postulated two dimensions of language—basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP). The former refers to the social, everyday language and skills that an English language learner (ELL) develops. It is very much context-embedded; it is always used in real-life situations that an ELL experiences in the real world. Examples of an individual's BICS include chatting about leisure activities, playing favourite sports at school, shopping for groceries, and interacting with friends. The latter, conversely, corresponds to abstract, decontextualised, and academic language. It requires higher-order thinking skills; it is the language required to succeed at school or in professional setting. Examples of CALP include attending and participating in lectures, comprehending academic texts, and presenting a paper in a seminar. Most ELLs find this language hard to master since they do not commonly deal with it in their everyday life. Hakuta et al (2000) reported that many researchers agree that an ELL may easily achieve BICS within two years, while he may take five to ten years to reach CALP.

Cummins' BICS/CALP framework and quadrants provide an account of why ELLs may acquire basic conversational fluency in English rapidly but would require much more time to attain academic language proficiency. It also explains why superficially fluent ELLs may still lack the language skills to achieve in school (Ranney, 2012). Levine and McClosky (2013) argued that learners who are advanced in the social language are not necessarily articulate in the academic language since there is a limited relationship between the two. Only those learners who achieve academic language mastery will reveal high academic achievement in the contain domain.

Research in the areas of integrated content and language instruction, such as the research in Mathematics and Science classrooms, shows that content has its own language: "[t]he language is specific or definite, precise or clearly expressed, and logical" (Levine & McClosky, 2013, p. 122). For instance, English terminology used in Mathematics may have meanings distinct from general English (Pimm, 1987). Thus, learners may flounder in their attempts to use terminology in Mathematics and, consequently could become extremely discouraged, unless their teachers provide necessary guidance (Cantoni-Harvey, 1987). Similarly, reading about Science is not the same as doing Science. In scientific texts, ideas are developed logically and associated with a number of linguistic features, such as word repetition, use of paraphrasing or semantically similar terms (Kessler & Quinn, 1987). In short, proficiency in the second or foreign language is necessary for learners to be successful in learning Mathematics and Science content taught in the target language. Thus, it is the level of second or foreign language proficiency of learners that is a factor likely to influence Mathematics and Science achievement (Levine & McClosky, 2013, p. 123). Learners need to master the language of Mathematics and Science first in order to achieve success in Mathematics and Science instruction (Lemke, 1990).

In addition to learners' proficiency in English, teachers providing content and language instruction also contribute to learners' success. Teachers are usually either content-trained or language-trained. They tend to focus on one of these aspects when teaching in an integrated content and language class, while keeping the balance between both. Lack of balance between content and language can be problematic. Pessoa et al. (2007) argued that focusing on content could neglect an explicit focus on language, which could be detrimental to students' language learning. Similarly, Dalton-Puffer (2007) suggested that language learning objectives become obscured when teachers are concerned with the depth of content

and coverage. In addition, Hoare (2003) agreed that language learning can be negatively affected when content-trained teachers emphasise content learning. Moreover, focusing on content may put students at risk of learning the target language incidentally (Lyster, 2007). However, "a lack of content focus provides an inadequate foundation for content and language learning … will not provide students with adequate support for learning" (Kong, 2009).

Given the fact that the integrated content and language instruction approach has gained much attention and been practiced by teachers in diverse educational contexts across the globe in the last few decades, it is interesting to see how this policy is articulated and implemented in the Indonesian teaching context. In this paper we report on a study of the attitudes of Mathematics and Science lecturers in an ISSTE program towards the policy of integrated content and language instruction implementation in a university in Indonesia. This report focuses on two questions: (1) how do Mathematics and Science lecturers view the policy of teaching Mathematics and Science in English? and (2) how do their views impact on their classroom instructional practices?

Method

This study employed a mixed-methods approach combining quantitative and qualitative data collection and analysis (Teddlie & Tashakkori, 2009). In the study, student and lecturer views were sought (Mirizon, 2014). In this paper, we focus on lecturer views. Data were collected through a survey of lecturers (20 respondents), interviews (12 participants) and classroom observations (four lecturers, with one class period observed for each).

The survey questionnaire was designed to gather information on lecturers' views on teaching content in English in the program and to gather demographic information, e.g. gender, teaching experience and qualifications. This questionnaire was adapted from Tan's (2009) instrument with her permission. It was written in both English and Bahasa in order to allow respondents to choose the language with which they were comfortable so that they would give the most appropriate responses. The instrument consisted of 23 statements with four-point Likert-type response scales. All items were worded positively and responses were scored from 1 (Strongly disagree) to 4 (Strongly agree). The statements in the questionnaire were formulated to represent four specific dimensions: (1) lecturers' views about the policy of teaching content in English (4 items); (2) lecturers' views of the support and resources provided to aid policy implementation (4 items); (3) lecturers' views of their own linguistic competence and content mastery (7 items); and (4) lecturers' impressions of students' content mastery and linguistic competence (8 items). Originally, 33 items were included in the instrument, but 10 items removed after reliability analysis revealed that they were a poor fit to the constructs of interest.

Questionnaire validity was checked via factor analysis and response consistency was checked using reliability analysis. Factor analysis revealed that the 23 retained items loaded onto their intended factors. Scales with high reliability (Cronbach's alpha exceeds 0.70) and relevant to their intended construct were used, while items with low reliability were removed for subsequent analyses. The questionnaire was not anonymous as respondents were asked to write their names on the questionnaire as part of demographic data. This enabled a cross-check with the data from interviews and observations and to identify those who agreed to participate in interviews.

The semi-structured interviews were based on a set of key questions to frame the conversation with the lecturers in the ISSTE program. Interviews were typically 45 to 50

minutes in duration and were audio-recorded. The interviews yielded information about the lecturers' academic backgrounds, teaching experiences, their views on teaching subject content in English, challenges encountered, preparations made, resources and support provided, information about students' socioeconomic, linguistic, and academic backgrounds, and lecturers' instructional practices. Participants were invited to take part in the interviews and were informed that participation was voluntary and that they could withdraw at any time and they were free to express their views. The interviews took place after participants had responded to the survey questionnaire and were conducted in participants' offices at a time convenient to them. The interviews were carried out by the lead author. Although the lead author and the participants worked in the same faculty in the university, they worked in different departments. In this case, the lead researcher positioned himself as an outsider in order to obtain valid and reliable data. The interviews were conducted in either English or Bahasa. English-proficient participants preferred the interviews in English, while those who were less proficient in English asked that the interviews be conducted in Bahasa. Responses of interviews conducted in Bahasa were literally translated into English by the lead researcher to preserve as closely as possible the expression of participants.

The classroom observations focused on lecturers' instructional practices. They were conducted to see how integrated content and language instruction was actually carried out in the classroom[1]. The observations were designed to triangulate information provided by participants in the interviews and questionnaire.

The data obtained from the questionnaire were analysed using descriptive statistical analysis (Allen & Bennet, 2010). Interviews were recorded and transcribed followed by member checking to build trustworthiness (Lincoln & Guba, 1985). A coding process was then carried out to identify major themes. The analysis of classroom observations was based on principles of CBI by identifying whether certain indicators emerged in teaching and learning activities. Both data obtained from interviews and classroom observations were analysed using thematic analysis (Babbie, 2010; Rivas, 2012; Silverman, 2011). Finally, a triangulation of data from survey questionnaire, interviews, and classroom observations was undertaken.

The participants of the study were the lecturers of Mathematics Education, Biology Education, Physics Education, and Chemistry Education, in the Mathematics and Science Department of the Faculty of Education in an Indonesian university. They had been appointed to this program based on criteria such as having at least ten years teaching experience, possessing excellent or good English proficiency, having studied overseas for their higher degrees (preferred) and qualified in subject areas taught. Twenty lecturers participated in survey questionnaire; each subject area being represented by five lecturers. Then they were invited to participate in interviews. Only 12 lecturers participated in the interviews. Four lecturers took part in the classroom observations, each representing a subject area. The characteristics of participants are summarised in Table 1 and in this table, the characteristics of those who took part in interviews are contrasted with those who only responded to the survey.

	Survey (no Interview)	Interview and Survey
Gender		
Male	16	9
Female	4	3
Experience (years)		
1-5 years	0	1
6-10 years	4	0

[1] Detail on the observation protocol can be obtained from the corresponding author

11-15 years	1	1
More than 15 years	3	10
Qualifications		
PhD,	6	6
MSc	14	6
Language proficiency		
Advanced	8	8
Intermediate	4	4
Pre-Intermediate	4	0
Elementary	4	0

Table 1: Summary of participant characteristics

From Table 1, it is apparent that those who elected to participate in the interview had more experience than those who responded to the survey only, and all who had doctoral degrees and who had higher self-rated language proficiency volunteered for the interviews.

Findings and Discussion

Lecturers' Views towards Integrated Content and Language Instruction

Findings from the Survey

Findings from the survey questionnaire revealed that more lecturers had positive rather than negative views about the policy of integrated content and language instruction or integrated teaching of Mathematics and Science in English which was indicated by the mean score of the responses as summarised in Table 2.

Dimensions of Views	Survey only	Survey and Interview	All
Lecturers' views towards the policy of teaching content in English	2.75	2.77	2.76
Lecturers' views of the support/resources provided to aid policy implementation	2.72	2.83	2.79
Lecturers' views of their own linguistic competence and content mastery	3.05	3.13	3.10
Lecturers' impressions of students' content mastery and linguistic competence	2.59	2.68	2.64

Note: Table 2 shows mean values of responses to scale items on each of the four perception scales. The scale ranges from 1 to 4 representing *strongly disagree*, *disagree*, *agree*, and *strongly agree* respectively.

Table 2: Participant views towards integrated content and language instruction

Findings shown in Table 2 confirm that on each of the four specific dimensions of views of CBI, lecturers tended to reveal positive views of the integrated teaching of Mathematics and Science in English policy. When the mean scores are compared, it can be seen that they felt more confident of their own linguistic competence and content mastery (mean 3.10) than that of their students. Such confidence might affect their positive views of the policy.

Findings from the Interviews

Two key findings emerged from the analysis of interview data: (1) teaching content in English raises lecturers' motivation; and (2) it increases lecturers' content knowledge because it enhances access to resources, most of which are in English.

Most lecturers acknowledged that the policy of teaching Mathematics and Science in English raises their motivation to use English. Findings obtained from the interview indicated that this motivation appeared based on the need to teach content in English because they were keen for opportunities to revive their English skills:

> *It's been a long time – I seldom use English, not like when I was studying abroad. I am really excited and motivated when lecturers have to use English in teaching Biology. I haven't practiced my English for quite a long time. (Participant 1)*

English-proficient lecturers, like Participant 1, were enthusiastic about the policy of integrated teaching of Mathematics and Science in English since they had the opportunity to make use of their English in teaching which they seldom had before. Similarly, data from interviews also showed that lecturers with less proficiency in English (such as Participants 2, 7, and 11), although initially disagreeing with the policy, were accepting of the policy of teaching Mathematics and Science in English. They were aware it was their responsibility to teach the content despite their lower proficiency in English. It motivated them to improve their English competence. Participant 2, for example, who had lower levels of English proficiency also endorsed the policy.

> *I am motivated to improve my English. It was not easy at the beginning, but I always try to improve my English. Now after three years teaching the same subject in English, I feel I enjoy it. (Participant 2)*

Although the English proficiency of Participant 2 was low, he was aware of the importance of having good English proficiency. He had experienced how important English was in pursuing higher degree studies (at the time the interview was conducted, he was continuing his doctoral degree in another university in the city). His experience in using English while pursuing higher degree study seems to explain the positive responses that he expressed.

Lecturers found that teaching Mathematics and Science in English increased their acquisition of content knowledge because it enhanced access to resources e.g. books, academic journals and online resources, most of which are in English. Understanding these texts requires them to have good reading skills, while good speaking and writing skills are needed to communicate the texts they read, as stated by Participant 5:

> *For me, teaching Chemistry in English increases my content knowledge acquisition. Having good English competence such as able to comprehend texts, able to communicate, write papers, etc., I can acquire knowledge written in English, so my content knowledge increases which helps me able to teach Chemistry in English. (Participant 5)*

Participant 5, who was proficient in English, could access resources written in English which later would increase her content knowledge acquisition. Indeed, she realised that increasing her content knowledge acquisition was useful, not just for teaching or sharing content knowledge with her students, but also as a means of upgrading her knowledge for her own professional development. In a similar view, less English-proficient lecturers, like Participant 11, also saw the possibility of increasing his content knowledge by developing his proficiency in English. In addition, as the head of Physics Education Study Program, he felt responsible to support the program. Therefore, he responded to the challenge of the policy

implementation even though he disagreed with the policy at the beginning of its implementation.

> *You know, I'm not that proficient with my English, especially in speaking and writing academically in my field, Physics. That's why I disagreed with this policy at the beginning. Then I realised, it is not sufficient if I only master the content of Physics. I can also find more knowledge in my discipline for my professional development if I master English. (Participant 11)*

Participant 7 shared the same opinion as Participant 11. Although initially he had disagreed with the teaching of Mathematics and Science in English, he no longer opposed the policy. He realised that his English mastery was not very good, but he saw some value in the policy. Having 30 years' experience teaching at the university he had adapted to many changes. In addition, he was favourably disposed to innovations. Like his colleague (Participant 2), Participant 7 was continuing his doctoral degree in another university in the city. It made him aware of the importance of having good English mastery in seeking knowledge.

> *I have been teaching maths in the mainstream classes for 30 years and I know how to make students understand the content well, but I used Bahasa of course. Now I need to use English. It is not easy but it is worth trying because English is needed for upgrading knowledge for my professional career. Although I disagreed with this before; then I thought today most resources are available in English including maths. I tried; you know, at the beginning I was not confident. In speaking I mixed Bahasa with English again and again. After I got the way of how to deliver maths using simple English, then my confidence grew. (Participant 7)*

The quotes above reveal that all lecturers participating in the interviews, whether they reported Advanced or Intermediate proficiency in English, acknowledged that the policy of integrated teaching of Mathematics and Science in English had positive impacts on their academic skills; that is, it raised their motivation to use English and increased their content knowledge, as expressed by Participants 1, 2, 5, 7, and 11.

Participant 5, who is proficient in English, reported that her experience as the former head of the Chemistry Education study program taught her about the importance of having good English mastery. She used to attend special interest group meetings in her field where information was frequently delivered in English. This kind of meeting required her to be able to communicate and share ideas in English. In particular Participants 7 and 11, although they realised that they are less proficient in English, admitted that having good English proficiency would be beneficial in that they could access more readily the many resources available in English. Being qualified in their subject area and mastering English skills, they believed could enable them to access more information in their disciplines. If they are resourceful, they would become knowledgeable and be able to develop their professionalism.

Impacts on Classroom Instructional Practices

Findings from interviews and classroom observations revealed that most lecturers established differences in their instructional practices if they were teaching in English compared to their practices in classes taught in Bahasa. The differences were in the content taught, teaching strategies applied, teaching media used to support the teaching and learning process, and student assessment.

Most lecturers made differences in the content taught by supplementing teaching materials in the ISSTE program. They wanted to enrich the content of the subject they gave to the students who learned the subjects in English:

I always try to give more to students. In terms of content, although the curriculum is the same, I prefer enriching the content by giving additional content related to the one stated in the curriculum so that ISSTE students get more information and become broad-minded. (Participant 4)

Since ISSTE students encountered more challenges in studying content in English and the program demanded more of them, lecturers thought that they deserved to learn more than the mainstream students. The lecturers hoped that it would help students understand the teaching materials. Participant 4 reported that he was aware of the challenge that students faced in learning content in English since not every students had good English proficiency. One of the ways to assist students was through enriching the content taught by providing a broader range of resources related to the content. This included handouts, papers, and online sources written in English which had already been simplified. This was meant to provide students with different readable and comprehensible learning resources to assist students who faced the challenge of studying content in English. For example, Participant 4 supplied the students with handouts and research articles related to the topic which he had already reviewed and commented on using simple English. In this way he provided students with additional information which made the topic, previously discussed in class, easier to understand. In addition, some self-study English resources related to language features used in the content, were provided, such as the use of passive constructions, clauses, and modality to support students' understanding of the learning materials. However, explicit language teaching of English related to the content taught was not provided by most lecturers. At the end of the observed session he gave supplementary materials to learn after class to support his efforts.

Differences in teaching approaches were not limited to content but involved the use of different teaching methods or strategies in ISSTE classes compared with mainstream classes taught in Bahasa. Additional methods and strategies used in the ISSTE classes focused on student-centred activities, such as cooperative learning, problem-based learning, ICT-based learning, and group discussion plus presentation, as expressed in the following excerpt:

> *In order to advance students' competence in expressing and communicating their ideas using English, the teaching strategies I use for teaching Physics are focusing on student-centred learning through cooperative learning, like group-work, pair work, and group presentations. I usually applied these in an ISSTE class. (Participant 6)*

In order to nurture students' abilities to interact and communicate in small groups and to stimulate their willingness to speak English, Participant 6 used group discussions when teaching Basic Physics 1 and 2. In addition, another lecturer tended to apply ICT to aid her teaching in the *Animal Structure* subject to Biology Education students with various teaching strategies, which she did not use in mainstream classes.

> *I used a different teaching strategy to teach Biology through the use of ICT. The expectation of this program is quiet high. We should use ICT; so more ICT-oriented. For ISSTE students, I employ different teaching strategies, which I don't really do much in the mainstream program. (Participant 3)*

These interview findings are consistent with the classroom practices witnessed during classroom observations, and substantiated what the lecturers had reported in their interviews. Participant 3 was observed to allocate students to groups for discussions leading to presentations. Students made use of ICT to search for learning materials, downloaded animations from the internet, prepared slide presentations, and took turns giving

presentations. ICT use was relevant when the teaching was conducted in English because so many more online resources are available in English compared with Bahasa.

In addition to differences made to content and teaching methods or strategies, lecturers also used alternative teaching media to support the teaching and learning process in ISSTE classes.

> *In Chemistry class, teaching media used are effectively selected in order to fully support students to understand the content taught easily, such as video animation which can help understand sophisticated things simpler and easier compared with when students have to understand a lengthy and detailed oral explanation given in English by the teacher. This kind of teaching medium is commonly used in the ISSTE class. (Participant 10)*

This lecturer realised that his students encountered two challenges when studying Chemistry in a foreign language; the first being the content itself, and the second being a foreign language as the language of instruction. He chose to teach using ICT-based media, such as educational animation videos. His rationale was to help his students understand the content taught in English more easily. Realising that not all of his students had good English mastery, he tried to lessen the English mastery constraints and help students comprehend the teaching materials by using appropriate teaching media. As illustrated in Figure 2, in this stage of learning content in English, students encounter language that is more demanding and more difficult to acquire, where high cognitive demand is imposed and contextual supports are not readily available. Students are initially introduced to the topics that are complicated and require abstract thought. These media were selected because they could reduce the high cognitive demand of specialist English language terms and make the content more accessible to the learners. Classroom observation findings confirmed the interview comments of Participant 10 where he made use of a 3D animation video he downloaded from a website when discussing the *Spectrometry* topic in Chemistry.

Other lecturers altered their assessment strategies in ISSTE classes. They set assignments that required students to seek information on the Internet. Exposure to the Internet required students to deal with commonly used English. Thus, the students would try to understand English to get the information; in this way, they would learn English.

> *In assessment, I gave different tasks to ISSTE students, such as a take home assignment or a project which requires Internet or ICT, where they could find more information from various sources or materials on the web to answer the questions asked or solve the problems given. (Participant 6)*

Some lecturers, like Participant 6, preferred assessing students' achievement by giving them a project to complete. Students would use ICT to find various sources of information to complete the assignment since there is greater availability of English-language resources. By doing this type of task, students are exposed to various sources related to content they need to read and learn while reinforcing their English competence. In a classroom observation of Participant 6, students were given a formative assessment task. Immediately after the class, students worked together in groups on the project assigned by accessing relevant websites to complete the project.

Certainly there are some reasons behind the differences lecturers established in their classroom instructional practices. Two key findings emerged from the analysis of interview data: They arose from expectations of the ISSTE program and from lecturers' own initiatives.

The lecturers decided to change classroom instructional practices to accommodate ISSTE program expectations. They understood that the program expected them to do so, even though this was not explicitly stated in the program documentation.

> *Different teaching strategies are used because the contents have to be taught in English. I did it because I wanted students to learn more English too; also*

because of the demand of the program. This program requires me to do so. (Participant 6)

Supplying more contents in the ISSTE class was in order to achieve the learning target; it was expected that students are able to master Physics content taught in English; that's the demand of the program. (Participant 12)

Since the objective of the program is to enable students to master English in addition to content mastery, lecturers modified their instructional practices to suit the program demands as reported above. The lecturers also reported that some differences were inspired by their own-initiatives, e.g. the use of alternative assessment tasks. It is interesting to note that this initiative was triggered by their wish to teach the content optimally and the feeling of satisfaction on seeing student success.

More demand from myself. I really want to teach content optimally in English, and it has become my satisfaction if students are successful in studying. So, I have to make an effort to make students understand. That's why I enrich the teaching materials by supplementing them. In this case, it's my own initiative; only my own will. (Participant 8)

Other lecturers' initiatives were triggered in order to make the content more accessible to students:

Applying various appropriate teaching strategies in ISSTE class was to make students understand the content taught. If I only employed a single strategy as I did in a mainstream class, students would find it difficult to understand. That's my own initiative. If they understand; it makes my job in teaching easier. (Participant 10)

Participant 10 reported that when he was teaching in the mainstream class using Bahasa, he usually applied a teacher centred approach by presenting the material through lecturing directly the students. When he was dealing with ISSTE students, he applied a student centred approach through cooperative learning. For example, he made use of a Jigsaw Technique in presenting a text related to a topic in Chemistry. Jigsaw is a technique that emphasises cooperative learning where students with different English levels have an opportunity to help each other in a group work. Each member of a group has the responsibility to become an 'expert' on a part of the assigned task and then 'shares' it with the other members of the team.

Another initiative was also triggered because lecturers did not want to see students fail their study because of their limited English mastery, not because they were incapable of understanding content. Therefore, they tried to help students by using teaching media that could simplify sophisticated and lengthy explanations.

Using different teaching media in ISSTE class is my own initiative because I don't want students to fail understanding the biology content taught because they don't understand English. I have a commitment that students must succeed in studying. They are smart students. I don't want them to fail because of the language of instruction used. (Participant 3)

Conversely, some lecturers believed that differences in classroom instructional practices applied in ISSTE program were not necessary. They reported that they had no reason for treating students differently, as a similar curriculum was used in ISSTE and mainstream classes:

I think we must give the same standard to the students whether we teach in Bahasa or English. In content, we must give the same standard. The curriculum used is the same, not different! I think the most important is the curriculum. If we use different curriculums, we have to change the content. In ISSTE classes, the

curriculum used is the same as in the mainstream program; the difference is only in using English as the language of instruction. (Participant 1)
Well, I learn that we have the same curriculum for mainstream and ISSTE programs so I treated students of both programs similarly, I mean, I only use English in the ISSTE classes, but not in the mainstream classes. (Participant 9)

For this reason, some lecturers did not make any modification in classroom instructional practices. They treated both ISSTE and mainstream students in similar way. No modification was made to content taught, teaching strategies applied, teaching media used, and assessment given to ISSTE classes; the only difference between the groups was the use of English rather than Bahasa as the language of instruction.

Findings from the Classroom Observations

The focus of the classroom observations was on examining aspects of teaching practices related to the integrated content and language instruction, namely content, language, teaching and learning activities, teacher-student interaction, teaching learning sources, and environment during teaching and learning activities.

In terms of content taught, all of the four observed lecturers taught content based on the curriculum but they put more focus on teaching content rather than the language. In relation to the language, all of them consistently used correct English but no overt discussion of English related to content taught was given. In the teaching and learning activities, they applied student-centred learning with various activities. In maintaining teacher-student interaction, they gave students opportunities to communicate in English by either actively involved in discussion or provided feedback throughout the lesson. Related to teaching and learning sources, they delivered the teaching materials using ICT. The classroom environment reflected a motivating English learning atmosphere where they actively using English although sometime mixed with Bahasa. Findings from the classroom observations accord with the findings from the interviews where lecturers conducted the activities that they reported in the interviews. These findings are also in line with the findings of the survey. The four lecturers who participated in the observations were those who showed their agreement with the policy of integrated teaching of Mathematics and Science in English and that their positive views towards the policy influenced their classroom instructional practices.

In summary, when findings from the survey, interviews, and classroom observations are compared, they demonstrate some similarities and some differences. The similarities that are apparent in the three sources include:

- more participants revealed positive views about the policy of integrated teaching of Mathematics and Science in English than those who did not,
- participants focused on teaching content and there was no overt discussion of linguistic aspects of English language, and
- participants lacked knowledge and skills in language teaching

Conversely, some differences are apparent. There were differences between those who responded to the survey only from those who also participated in the interviews. This might explain the differences in the survey and interview findings. Different educational backgrounds might contribute to differences in participants' views of the CBI initiative as more interviewees had doctoral level qualifications. Further, interviewees reported higher levels of English language proficiency than those who only responded to the survey. These differences may account for variations in responses to the ISSTE policy initiative and in their classroom instructional practices. These differences in qualification levels and in English language proficiency between the interviewees and survey-only respondents are a limitation

of the study. The interview participants may not reflect the views of all lecturers in higher education who may in future be required to implement a CBI approach.

Conclusion and Implications

The objective of this study was to investigate the implementation of integrated Mathematics and Science teaching in English at a university in Indonesia. It evaluated the lecturers' views towards the policy and its impacts on classroom instructional practices.

Findings from survey questionnaire and interview data indicated that most lecturers held positive views on the implementation of integrated Mathematics and Science teaching in English. They revealed that integrated Mathematics and Science teaching in English raises their motivation and increases their content knowledge acquisition. Although some lecturers interviewed (3 out of 12—Participants 2, 7, and 11) initially disagreed with the policy of integrated Mathematics and Science teaching in English, they were aware of the importance of having good English proficiency. In addition, they realised that it was their responsibility to teach content in subjects but they were less-proficient in English compared to their other colleagues.

The lecturers' views on the implementation of integrated Mathematics and Science teaching in English had impacts on their classroom instructional practices. When they taught the ISSTE classes they applied different approaches, which they did not use when they taught the same content subjects in the mainstream classes. Modifications were made in enriching content taught, applying student-centred teaching methods, making use of various teaching media, and assessing students learning. They were meant to assist students to understand the content taught in English. They realised that they were training prospective secondary school teachers who were also expected to teach content in English later. This effort was certainly challenging since it was related to students' readiness for learning content in English.

Findings of this study revealed that lecturers' positive views on the implementation of integrated Mathematics and Science teaching in English reflected their proficiency in English and their experience of using English in their prior overseas postgraduate degrees in English-speaking communities. They were confident teaching content in English (as indicated in the interview data). Those who initially disagreed with the policy of implementing integrated Mathematics and Science teaching in English seemed less confident using English for teaching content. However, they were motivated to improve their English competence. They were willing to make efforts, as they saw positive sides of teaching and learning content in English (Brown, 2007).

Modifications in classroom instructional practices were triggered by the lecturers' understanding of the program expectation and their own initiative. They also reflected lecturers' pedagogical knowledge. Pedagogical knowledge refers to an understanding of how to teach and may include "facilitating students' thinking and learning, planning lesson, selecting appropriate sources, catering to students' different needs, managing class, and supporting students' holistic development" (Choy et al., 2011, p. 83). To some degree, this pedagogical knowledge influences the way lecturers deal with their students (McCroskey et al., 2004). Those modifications may help students understand content taught in English to some extent but their comprehension also depends on the students' English proficiency. In other words, no matter what sophisticated teaching methods or strategies are applied or diverse teaching media used by lecturers, they will not be much use in helping students understand the content taught in English if the students' English proficiency is limited. It implies that effective implementation of integrated Mathematics and Science teaching in English should be supported by enhancing students' English proficiency. A lack of any focus on the teaching English was apparent in the classroom observations. The four observed

lecturers' focus was on teaching subject content. No overt attention was given by those lecturers to teaching English related to the content taught. Since this was the case, students' English language skills were not developed to the extent they could have been. In other words, if content is simply taught through English without overt attention to teaching English, learners' English proficiency is unlikely to develop (Cummins, 1981; Snow, Met, & Genesee, 1989).

Moreover, lecturers' very good English proficiency would not suffice; it should also be accompanied by their knowledge and skills in language teaching, their knowledge about the Content-Based Instruction framework and how it works in their teaching context. In most cases where students are expected to learn a second or foreign language, the teachers should have sufficient knowledge and skills in language teaching. Although the majority of lecturers were English-proficient and had experience in English as a medium of instruction they lacked of knowledge and skills in language teaching. In addition, they were not really familiar with the Content-Based Instruction framework. This was apparent from their responses during the interviews, where only few of them were familiar with Davison & Williams' (2001) language continuum (as illustrated in Figure 1) and Cummins' (1984) CBI framework (as illustrated in Figure 2). Horn (2011) claimed that in order to manage successful integrated content and language instruction, content teachers should possess advanced language skills and the pedagogy for language teaching that will support them to fulfil the need of a range of language-use tasks which include classroom management practices and CBI framework.

What was also lacking in the instructional practices in this program was cooperation between the content-specialist and the language-specialist. Although in SBIs, the curriculum adopts language conscious content teaching, collaborative work between Mathematics and Science lecturers and lecturers of English within the institution could have been initiated. It may take form of support given by lecturers of English for content lecturers before they come to class for teaching, such as in arranging what language aspects or language skills need to be included in content curriculum at the time of its development, or in terms of language aspects or language skills content lecturers need to discuss with students in the class. It may also take the form of information exchange (sharing information with regard to students), shared decision-making (coming together to arrive at a consensus on a certain action) (Pawan & Ortloff, 2011, p. 466). Another form may be content lecturers asking for lecturers' of English assistance to correct the language of the tasks or tests they are going to give or have administered (Dale & Turner, 2012, p. 21).

Lecturers' views towards the integrated teaching of Mathematics and Science in English policy may affect their classroom instructional practices. As indicated by the findings of this study, lecturers' positive views were a reflection of their English proficiency, strong pedagogical knowledge of content subject, and relevant content area qualifications. These credentials contributed to the teaching modifications in their classroom instructional practices. Such modifications were aimed to assist students in learning the content in English. It may be helpful to some extent, but it still depends on the students' English proficiency and readiness to learn. Lecturers' knowledge and skills in language teaching, in addition to strong content knowledge mastery, is required. Further, collaboration between content-area and English specialists is also desirable. Lecturers' understanding of how CBI works in the integrated teaching of Mathematics and Science in English is necessary and needs to put it into practices in order to succeed in implementing the program in the Indonesian context.

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