

### *A higher-education teaching module for integrating industry content and language through online recruitment advertisements*

Dietmar Tatzl

FH Joanneum University of Applied Sciences, Graz, Austria

[dietmar.tatzl@fh-joanneum.at](mailto:dietmar.tatzl@fh-joanneum.at)

#### Abstract

Empirical evaluations of practical teaching units integrating content and language in higher education are rare and deserve more attention. The current article aims to narrow this gap by providing an empirical study of an integrating content and language in higher education (ICLHE, Smit & Dafouz, 2012) teaching module. It investigates the effectiveness of a content-based English for specific purposes module in tertiary aeronautical engineering education, which incorporates recruitment advertisements as online resources. The study adopted a mixed-methods approach and surveyed three aeronautical engineering student groups ( $N = 141$ ) over three consecutive years on their perceptions of the module's learning outcomes. This longitudinal survey was complemented by a teacher-assessed writing task and a qualitative content analysis of online recruitment advertisements ( $N = 80$ ) in a self-built corpus. All three year groups rated the 10 questionnaire statements on a 5-point Likert scale rather equally, thus suggesting a similar perception of academic achievement stemming from the module's completion. This student view was supported by the results of the writing assignment. In short, the module's effectiveness was corroborated both quantitatively and qualitatively, which identifies this teaching concept as a feasible way forward.

*Keywords:* English language teaching; content-based instruction; specialised corpus; online recruitment advertisement; aeronautical engineering

## 1. Introduction

Integrating content and language (ICL) has become a goal for many degree programmes in higher education (HE, Smit, & Dafouz, 2012). The form and scope of such integration, however, varies from institution to institution, ranging from the ideal of full integration in all courses of a programme to lesser degrees of integration in single courses, modules and units. At the tertiary level, full integration may remain difficult to achieve and even not be desirable, as it involves many issues, pitfalls and intricacies (see Abello-Contesse, 2013, pp. 12-13; Baetens Beardsmore, 2009; Doiz, Lasagabaster, & Sierra, 2013; cf. Bruton, 2011; Paran, 2013, for controversial aspects of content and language integrated learning [CLIL] at secondary level). A central issue is that of deskilling content and language teachers (Paran, 2010) when both content and language goals should be pursued in all courses because most university lecturers are experts in their academic fields but not in languages, whereas most tertiary language professionals have no deep knowledge of students' disciplines and their respective subfields (Abello-Contesse, 2013, p. 13, p. 17; Räisänen & Fortanet-Gómez, 2008, p. 48; Snow, Met, & Genesee, 1989, p. 214; Studer, Pelli-Ehrensperger, & Kelly, 2009, p. 13; Tatzl, 2011a, p. 261). Even native-speaking content teachers usually have not been educated in linguistics or the target language of instruction in foreign-medium degree programmes. As a consequence, it may be reasonable not to aim at full but partial integration of content and language objectives and find integration niches in single course units or modules.

This article evaluates the effectiveness and validity of such a content and language integrated module for familiarizing aeronautical engineering students with industry requirements and professional tasks, processes and contexts.

## 2. Literature review

It has been emphasised across industries and businesses that excellent communication skills are indispensable for employment (CBI Higher Education Task Force, 2009, p. 6; Engineering Council, 2004/2010, p. 12; Lamb et al., 2010, pp. 11-12). Today, this mainly means communication in English, the global *lingua franca* (cf. Jenkins, 2007; Kachru, 1988, as cited in Crystal, 2003, pp. 60-61; Prodromou, 2008; Seidlhofer, 2001), which is why tertiary English for specific or academic purposes (ESP/EAP) language teaching and learning needs to form a constituent component of content degree programmes. As it remains doubtful whether content experts should be expected to teach language or are capable thereof, full integration across all courses in a programme may remain an unattainable myth for many institutions. In higher education, full integration is rather

an ideal constructed by proponents of CLIL that is rarely questioned as a programme development goal (Llinares, Morton, & Whittaker, 2012, p. 215; cf. Marsh, Pavón-Vázquez, & Frigols Martín, 2013). Furthermore, it is by no means certain that increasing the time of exposure to a target language through full immersion will necessarily lead to linguistic gains for students, as Ament and Pérez-Vidal's (2015) comparison of a semi-immersion and immersion group suggests. Their semi-immersion group showed a "significant gain in grammar skills" (p. 63), which was not visible in the full immersion group.

In any event, there are degrees of integration on a continuum from full integration to no integration. For instance, Met (1999) has classified content-based language teaching (CBLT) on a continuum from *content-driven* to *language-driven* poles. For her, total immersion is at the extreme content end, whereas "language classes with frequent use of content for language practice" (p. 7) lie at the opposite end (cf. Paran, 2013, p. 321). The centre of her scale consists of subject courses taught in a second language, subject courses with language instruction and language classes based on themes, which largely corresponds to Brinton, Snow, and Wesche's (1989/2003) sheltered classes, adjunct model and theme-based courses. This continuum has been recently expanded by Tedick and Cammarata (2012, p. S31), who have added the dimensions of *high* and *low time-intensive* to further categorize and define integration. Another classification of English-taught university courses was provided by Unterberger and Wilhelmer (2011), who have identified five types with differing aims, target groups, teaching staff, pedagogical approaches, teaching formats, roles of language and expected learning outcomes: ESP, ESP/EAP, English-medium instruction (EMI), Adjunct-ICLHE and ICLHE (pp. 95-97; see also Greere & Räsänen, 2008, p. 7). This classification views the medium of instruction as the lowest common denominator across language (ESP) as well as subject courses (EMI).

Despite such categorisations, content programmes taught through a foreign or second language often lack linguistic learning objectives. There is, however, the necessity for an explicit focus on forms and functions in academic registers and genres, varying with the level of immersion in the target language (Llinares et al., 2012, pp. 214-215; cf. Costa, 2012). It follows that a need exists for "language activities . . . specific to the content taught" (Ament & Pérez-Vidal, 2015, p. 51), although such a need is not limited to ICLHE settings but extends to ESP/EAP courses as well.

Similarly, the integration of content and language is not confined to content programmes taught through a foreign or second language but is also characteristic of ESP/EAP courses. It is not the formal classification of a programme or course that identifies its level of integration but rather the individual realization of content and language objectives in each course, module, unit or activity that matters. Concrete

successful examples of integrating content and language in higher education within ESP/EAP and CBLT frameworks have been reported on project work (Tatzl, 2015b; Tatzl, Hassler, Messnarz, & Flühr, 2012) and case meetings (Tatzl, 2015a).

Among the multifarious levels of integration in tertiary contexts, a feasible way forward consists in solutions that leave linguistic instruction to the expertise of language teachers. The literature on single content and language integrated teaching units or modules in higher education, however, is still scarce, even more so when empirical evidence is a key criterion for the search. Empirical investigations tended to concentrate on full programmes or approaches (see, e.g., Snow & Brinton, 1988). Promising activities for ICLHE teaching units were described by Foran-Storer (2007, pp. 313-315). Furthermore, Carrió Pastor and Gimeno Sanz (2007, p. 109) produced a collection of online activities drawing on content websites in industrial engineering. The current article intends to narrow this gap by contributing an empirical study of an ICLHE teaching module in aeronautics.

### 3. Institutional background and module design

The FH Joanneum University of Applied Sciences, Graz, Austria, hosts a divergent range of graduate and postgraduate degree programmes. The seminar accommodating the module described here is located in the first semester of a three-year bachelor's programme in aviation, which leads to a science in engineering degree. The programme, therefore, mainly draws on science, technology, engineering and mathematics (STEM) disciplines but also contains mandatory English language courses from the first to the fifth semester of study, each bearing two European Credit Transfer and Accumulation System (ECTS) credits. These credits translate into two teaching hours per week over 15 weeks. The content curriculum is delivered through the students' first language, German.

The seminar in question may be classified as an adjunct theme-based ESP/EAP course in Brinton et al.'s (1989/2003) terms. It is entitled Aviation Industry English and incorporates various themes that play a role in this particular sector. It is also adjunct in the sense that it accompanies the first semester of study with linguistic support, even though the content courses are not taught through English. Thus, it does not exactly correspond to Brinton et al.'s (1989/2003) definition of an adjunct language course as being paired with a single subject course, yet it is closely connected with certain curricular contents of the first semester. One of the curricular goals in the first semester is to introduce students to the aeronautics industry, which also formed the rationale for the ICLHE module in this adjunct theme-based ESP/EAP course.

The module design was guided by the principle of "giving students the power to conduct their own domain-specific analyses" (Wilkinson, 2003, p. 179)

using authentic online resources (cf. Duensing & Batstone, 2004; Fürstenberg & Kletzenbauer, 2012; Kasper, 2000b; Luzón Marco & González Pueyo, 2006). A detailed description of the module was published in a conference paper (Tatzl, 2011b), which is why it will only be briefly summarised here. The module comprises five teaching hours within two weeks and exploits online recruitment advertisements from the aerospace sector. Students use these advertisements as resources for identifying employment profiles, qualifications, skills and personal strengths required of aeronautical engineers. An in-class analysis of the aeronautics industry through the lens of such online vacancies ends in short group presentations of various engineering positions, so that learners gain an overview of the sector in content terms and acquire technical vocabulary, expressions and chunks of words in language terms. The in-class activities of this module lead to a writing assignment which may be characterised in Littlejohn and Hicks's (1987) words as a "writing simulation" (p. 76). For this purpose, students need to choose an online aerospace vacancy and prepare application documents for the position advertised. In this way, the new language input from the in-class activities is processed and reinforced through a writing task.

#### 4. The study

##### 4.1. Rationale and research questions

This article supports the rationale that engineering students can be familiarized with their future career fields and the related linguistic requirements through a course module based on online recruitment advertisements. Engineering bodies have called for such close links to ensure "that course content reflects the real requirements of industry" (The Royal Academy of Engineering, 2007, p. 6). Students of scientific and engineering disciplines tend to be motivated to follow foreign language courses for instrumental reasons of career orientation rather than out of deep integrative interest (Coleman, 2012, p. 18). This is why the module under investigation was deemed suitable for teaching ESP to aeronautical engineering students from an industry-related perspective. As online recruitment advertisements blend descriptions of content domains and workplaces with specialist language, this text type promised to be an effectual instructional resource for a communicative content-based ESP approach. This study evaluates the ICLHE module's effectiveness and validity in empirical terms to contribute to the research on content and language integrated teaching techniques in ESP/EAP.

Six research questions were formulated from multiple angles, using both quantitative and qualitative methods of data analysis. Each of the six questions

pursued complementary objectives that should lead to a sound empirical estimation of the module's effectiveness for ESP contexts. The first three questions aimed at identifying the ICLHE module's usefulness quantitatively, as perceived by different student groups. A qualitative analysis of students' free verbal feedback attempted to compare this with descriptive teacher assessment of the module's writing task. The fifth question juxtaposed the results of the second question with the writing grades, and the sixth question was answered through a qualitative content analysis of selected recruitment advertisements in a self-built corpus.

1. Are there differences in the ratings of content and language items by students?
2. Are there differences in the perceived academic achievement of the three year groups surveyed?
3. Are there significant correlations between content and language items on the questionnaire?
4. Does the free verbal student feedback confirm the results of the teacher-assessed module assignment?
5. Is the perceived academic achievement of student groups mirrored by the teacher-assessed module assignment?
6. Do online recruitment advertisements serve as appropriate input for raising students' awareness of industry requirements and subject-specific language in aeronautical engineering?

## 4.2. Methods

This evaluation of a content-based language teaching module on industrial and linguistic requirements imposed on engineering students adopted a mixed-methods approach with the triangulation of quantitative and qualitative data. In this way, the internal validity of the research was strengthened, and the different data sources enabled multiple perspectives on the module's feasibility and effectiveness for integrating content and language in ESP. The methods employed in this research were a questionnaire survey, teacher assessment of student texts and a content analysis of authentic online resources.

### 4.2.1. Survey

The main quantitative part of this research represented a cross-sectional between-subject analysis of questionnaire variables with three different subsamples surveyed in three consecutive years. These three student year groups combined constituted one convenience sample within the homogeneous partial population of aeronautical engineering students at the author's institution.

#### 4.2.1.1. Participants and sampling

The participants in the survey were first-year bachelor's students in the author's course Aviation Industry English. They had all taken the ICLHE module at the beginning of the course, which was taught without variation to three different student cohorts in three consecutive years from 2012 to 2014. Sampling was non-random and included the full student year group in each case. Ethical standards were met, as student participation in the survey was voluntary, and participants were assured of the anonymous and confidential treatment of the data for research purposes (British Educational Research Association, 2011). A statement to this end was included on the survey sheet, and students gave their consent to the use of their data by completing and returning a questionnaire form. The intended sample size for this research was 105 participants, estimated from the number of 35 regular study places per year in this degree programme. As more students were allowed into the programme in each year of the investigation, the actual sample size could be extended ( $N = 141$ ).

#### 4.2.1.2. Survey research design

The survey form used for this research was an ad hoc instrument designed to gather data on engineering students' evaluation of an ICLHE teaching module. The survey consisted of five questions on personal data, five questions on content learning and five questions on language learning. The questionnaire's main part on perceived content and language learning outcomes applied a 5-point Likert scale (0 = *Not at all*; 1 = *Slightly*; 2 = *Noticeably*; 3 = *Greatly*; 4 = *Very much*) for each item. The 10 items were:

##### Content

1. The module has introduced me to the discipline of aeronautical engineering and the field of aviation.
2. The module has provided me with orientation concerning the aerospace industry's demands on engineers.
3. The module has provided me with industry insights in an authentic learning environment.
4. The module has raised my awareness of my own educational needs.
5. Through its focus on employment prospects after graduation, the module has strengthened my motivation to study aviation.

##### Language

6. The module has improved my technical vocabulary knowledge of aviation and recruitment.
7. The module has improved my aviation-related spoken interaction skills.

8. The module has improved my aviation-related reading skills.
9. The module has prepared me for writing a letter of application and a CV to an aerospace company.
10. Through its use of authentic online industry materials, the module has strengthened my motivation to learn English.

Survey data were gathered face-to-face. The questionnaire was distributed in paper form to each year group at the end of the teaching module but before students received the teacher-assessed results of their writing assignments. In this way, student bias caused by positive or negative grades could be ruled out. All completed questionnaires were collected again on the same day.

SPSS® Statistics (Version 22, 1989/2013) was used for data analysis. Participants' personal data were analyzed by means of descriptive statistics. The first research question on differences in the ratings of content and language items by students was answered with a Friedman test statistic ( $F$ ) and comparison of mean ranks. The second research question on group differences in perceived academic achievement was examined using the Kruskal-Wallis test. For detecting significant correlations between content and language items on the questionnaire, Spearman's rho was calculated to answer the third research question, exploring potential relationships among the module's outcomes.

#### 4.2.2. Teacher-assessed module assignment

The teacher-assessed module assignment comprised all participants in the sample ( $N = 141$ ). The teacher graded students' application documents (cover letter and curriculum vitae) according to the Austrian national scheme, where 1 corresponds to an excellent mark and 5 to a fail. The medians and frequencies of the grades were compared across groups descriptively to answer the fifth research question whether the perceived academic achievement of student groups mirrored the results from the teacher-assessed module assignment. Concerning the fourth research question, the free verbal student feedback from the survey was processed qualitatively to investigate whether it supported the results of the teacher-assessed module assignment.

#### 4.2.3. Qualitative content analysis of online recruitment advertisements

Online resource materials have increasingly attracted the attention of researchers in the tertiary education sector (see Brezina, 2012; Kasper, 2000a), and methods are being developed to extract technical vocabulary from source texts and corpora for shaping ESP learning materials (see Kwarj, 2011). Furthermore, the value

of small, specialized and self-built corpora has been recognized by researchers (see Charles, 2012). For these reasons, the ESP teacher-researcher generated a small corpus of online recruitment advertisements ( $N = 80$ ) for a qualitative content analysis to answer the sixth and final research question whether this text type served as appropriate input for raising students' awareness of industry requirements and subject-specific language in aeronautical engineering. The analysis was conducted with MAXQDAplus® (Version 11, 1989/2012).

The sampling of texts for the corpus was semi-random using seven online aerospace employment search engines. The search criteria were based on the most frequently student-selected vacancy titles (Appendix, Table 1) and additional advertisements to cover various industry subsectors. The corpus was built in January 2015 and contains a cross section of vacancies advertized at that time. A frequency count with MAXDictio, an extension of MAXQDAplus®, revealed that the corpus consists of 30,216 words, with a minimum number of three characters defining a single word.

### 4.3. Results

The results of this study are reported with respect to the methods applied. The quantitative student survey and assessment results are followed by the outcomes of the qualitative content analysis of online employment advertisements in the self-built corpus.

#### 4.3.1. Student survey results

The student survey data were analysed by way of SPSS® Statistics (Version 22, 1989/2013). A one-sample Kolmogorov-Smirnov test for all variables in the whole data set revealed that the observed distribution differed significantly (at the \*\*\* $p \leq .001$  level, 2-tailed) from the normal distribution. As a consequence, the data set was analysed by means of descriptive and non-parametric statistics. The internal validity of the questionnaire was tested and resulted in Cronbach's alpha of .766.

##### 4.3.1.1. Participants

The sample surveyed consisted of first-year aeronautical engineering students ( $N = 141$ ) enrolled at the Institute of Aviation from three different year groups in consecutive years. Table 1 shows the demographic variables for the full sample. On average, the groups were of comparable age ( $M = 20.5$ ) and had received the same number of years in previous formal English language training ( $M = 9.0$ ). Most students were male Austrian German native speakers, followed by the second-largest

group of students from Germany. In other words, it was a very homogeneous sample that afforded no interesting comparisons of male to female, Austrian to non-Austrian or German native-speaking to non-German native-speaking learners.

Table 1 Descriptive statistics for biographical variables

Variable	Year group	<i>M</i>	<i>Mdn</i>	<i>SD</i>	MIN	MAX
Age <sup>a</sup> (in years)	Group 1	20.2	20.0	1.3	18	24
	Group 2	21.0	20.0	2.8	18	32
	Group 3	20.3	20.0	1.5	18	24
	Combined	20.5	20.0	2.0	18	32
Formal English language training (in years)	Group 1	8.9	9.0	1.7	4	14
	Group 2	9.0	9.0	1.7	5	15
	Group 3	9.0	9.0	1.6	3	14
	Combined	9.0	9.0	1.7	3	15
Variable	Level	Sample frequencies				
		Group 1	Group 2	Group 3	Combined	
Gender	male	45	45	44	134	
	female	3	1	3	7	
Nationality <sup>b</sup>	Austrian	44	38	40	122	
	German	3	5	5	13	
	Hungarian	0	1	0	1	
	Italian	1	1	0	2	
	Slovenian	0	1	0	1	
First language <sup>c</sup>	German	47	43	45	135	
	German & Hungarian	0	0	1	1	
	Hungarian	0	1	0	1	
	Ladin (Romance language)	1	0	0	1	
	Slovenian	0	1	0	1	
	Turkish	0	0	1	1	

Notes. *N* = 141; Group 1 *N* = 48; Group 2 *N* = 46; Group 3 *N* = 47; *M* = arithmetic average; *Mdn* = median; *SD* = standard deviation; *MIN* = minimum in sample; *MAX* = maximum in sample

<sup>a</sup> Missing values because of nonresponse: *N* = 1; <sup>b</sup> missing values: *N* = 2; <sup>c</sup> missing values: *N* = 1

#### 4.3.1.2. Content and language integrated learning items

The first research question on differences in the ratings of content and language items by students was answered by means of non-parametric statistics. A Friedman test with all Likert-scale variables and the total sample (*N* = 141) revealed that the mean ranks differed significantly for the content statements (at the  $**p \leq .01$  level) as well as language statements (at the  $***p \leq .001$  level), which led to the rejection of the null hypothesis that the medians were equal across all items (Tables 2 and 3). In fact, six statements lay above the mean rank of the  $H_0$  assumption or above 3.0. A separate comparison of the content and language

items revealed that the medians for each statement also differed within each year group (Group 1 to Group 3), but that these differences were not that far from the median (Tables 4 and 5). In other words, the mean rank of only one content statement was clearly below the median, and that was *Industry insights in authentic learning environment* with a mean rank of 2.63. Concerning language, the items *Improved aviation-related spoken interaction skills* (2.30) and *Improved aviation-related reading skills* (2.39) clearly ranked below the median. The item *Preparation for writing application and CV in aerospace* (4.04) achieved the highest mean rank of all statements, thus lying far above the median. It is important to note that the groups analysed with the Friedman test were not the year groups but the groups of five content and five language statements on the questionnaire respectively. In other words, the Friedman test aimed at detecting differences between two sets of items.

Table 2 Friedman test results across groups for content items

Test statistics	Year group sample			
	Group 1	Group 2 <sup>a</sup>	Group 3 <sup>b</sup>	Combined <sup>c</sup>
<i>F</i> /Chi <sup>2</sup>	10.182	8.175	2.213	15.259
<i>df</i>	4	4	4	4
Asymp. sig.	.037*	.085	.697	.004**
Decision	reject H <sub>0</sub>	retain H <sub>0</sub>	retain H <sub>0</sub>	reject H <sub>0</sub>

Notes. *N* = 141; Group 1 *N* = 48; Group 2 *N* = 46; Group 3 *N* = 47; *F* = Friedman statistic; *df* = degrees of freedom

<sup>a</sup> Missing values because of nonresponse: *N* = 1; <sup>b</sup> missing values: *N* = 1; <sup>c</sup> missing values: *N* = 2

Significance levels: \*\*\**p* ≤ .001; \*\**p* ≤ .01; \**p* ≤ .05

Table 3 Friedman test results across groups for language items

Test statistics	Year group sample			
	Group 1	Group 2 <sup>a</sup>	Group 3 <sup>b</sup>	Combined <sup>c</sup>
<i>F</i> /Chi <sup>2</sup>	52.781	47.653	48.133	143.799
<i>df</i>	4	4	4	4
Asymp. sig.	.000***	.000***	.000***	.000***
Decision	reject H <sub>0</sub>	reject H <sub>0</sub>	reject H <sub>0</sub>	reject H <sub>0</sub>

Notes. *N* = 141; Group 1 *N* = 48; Group 2 *N* = 46; Group 3 *N* = 47; *F* = Friedman statistic; *df* = degrees of freedom

<sup>a</sup> Missing values because of nonresponse: *N* = 1; <sup>b</sup> missing values: *N* = 1; <sup>c</sup> missing values: *N* = 2

Significance levels: \*\*\**p* ≤ .001; \*\**p* ≤ .01; \**p* ≤ .05

A comparison across the three student groups by means of a Kruskal-Wallis test with the year groups as grouping variables answered the second research question on differences in the perceived academic achievement of the three student samples. This comparison resulted in little differences for the ratings of each statement by each group. In fact, all three year groups judged the statements rather equally, thus demonstrating a similar perception of academic achievement,

with the single exception of the item *Industry insights in authentic learning environment* ( $p = .043^*$ ), which yielded the lowest mean rank for Group 1 students (59.73) and the highest one for Group 3 students (78.05), so that the  $H_0$  of equal medians for group achievements was retained for the other nine items.

Table 4 Friedman comparison of mean ranks for content items on the questionnaire per group

Content items	Mean ranks			
	Group 1	Group 2	Group 3	Combined
Introduction to aeronautical engineering and aviation	3.02	3.02	2.92	2.99
Orientation concerning aerospace industry's demands <sup>a</sup>	3.06	2.96	3.15	3.06
Industry insights in authentic learning environment <sup>b</sup>	2.48	2.57	2.84	2.63
Raised awareness of own educational needs <sup>c</sup>	3.31	3.13	3.17	3.21
Strengthened motivation to study aviation	3.13	3.32	2.91	3.12

Notes.  $N = 141$ ; Group 1  $N = 48$ ; Group 2  $N = 46$ ; Group 3  $N = 47$

<sup>a</sup> Missing values because of nonresponse:  $N = 1$ ; <sup>b</sup> missing values:  $N = 1$ ; <sup>c</sup> missing values:  $N = 1$

Table 5 Friedman comparison of mean ranks for language items on the questionnaire per group

Language items	Mean ranks			
	Group 1	Group 2	Group 3	Combined
Improved vocabulary knowledge of aviation and recruitment	3.32	2.84	3.27	3.15
Improved aviation-related spoken interaction skills <sup>a</sup>	2.27	2.41	2.22	2.30
Improved aviation-related reading skills <sup>b</sup>	2.35	2.42	2.39	2.39
Preparation for writing application and CV in aerospace	4.02	4.16	3.93	4.04
Strengthened motivation to learn English	3.03	3.17	3.18	3.13

Notes.  $N = 141$ ; Group 1  $N = 48$ ; Group 2  $N = 46$ ; Group 3  $N = 47$

<sup>a</sup> Missing values because of nonresponse:  $N = 1$ ; <sup>b</sup> missing values:  $N = 1$

The third research question on significant correlations between content and language items on the questionnaire yielded results that were analysed by means of Spearman's rho, as the data were not normally distributed. Spearman's rho showed significant correlations at the  $p \leq .01$  level (2-tailed) between many variables. Table 6 displays the results of this analysis.

#### 4.3.1.3. Free verbal student feedback from the questionnaire

The free verbal student feedback gathered from the survey was divided into nine approving categories and two categories of *criticism* and *suggestions for improvement*. The majority of comments expressed gains from the module and its effectiveness in the areas of *employment preparation, technical English, materials, task integration, group work, reflection on own skills, practical orientation*

and *raised motivation*. A brief selection of exemplary statements included “good idea. Innovative,” “just benefits for the students,” “very interesting content” or “This module provided a lot of useful information.” The more critical voices addressed aspects such as time constraints and the effort spent on searching for employment advertisements and writing a set of application documents.

Table 6 Spearman’s rho correlations table of content and language questionnaire items

Variables	1	2	3	4	5	6	7	8	9	10
1 Introduction to aeronautical engineering and aviation		.460**	.434**	.203*	[n.s.]	.264**	.326**	.326**	.267**	.206**
2 Orientation concerning aerospace industry’s demands <sup>a</sup>			.313**	[n.s.]	[n.s.]	.242**	.399**	.242**	.188*	.185*
3 Industry insights in authentic learning environment <sup>b</sup>				[n.s.]	.191*	.347**	.291**	.232**	[n.s.]	.191*
4 Raised awareness of own educational needs <sup>c</sup>					[n.s.]	[n.s.]	[n.s.]	[n.s.]	.296**	.351**
5 Strengthened motivation to study aviation						[n.s.]	[n.s.]	.264**	.225**	.400**
6 Improved vocabulary knowledge of aviation and recruitment							.483**	.405**	[n.s.]	[n.s.]
7 Improved aviation-related spoken interaction skills <sup>d</sup>								.484**	[n.s.]	.196*
8 Improved aviation-related reading skills <sup>e</sup>									.287**	.412**
9 Preparation for writing application and CV in aerospace										.311**
10 Strengthened motivation to learn English										

Notes. *N* = 141; <sup>a</sup>missing values because of nonresponse: *N* = 1; <sup>b</sup>missing values: *N* = 1; <sup>c</sup>missing values: *N* = 1; <sup>d</sup>missing values: *N* = 1; <sup>e</sup>missing values: *N* = 1

\*\* Correlation significant at the *p* ≤ .01 level (2-tailed); \* significant at the *p* ≤ .05 level (2-tailed)

Table 7 Medians and frequencies of grades on the module assignment per group

				<i>Mdn</i>
	Group 1	Group 2	Group 3	Combined
	2.00	2.00	2.00	2.00
Grade levels <sup>a</sup>				Frequency
Excellent (1)	7	6	6	19
Good (2)	26	19	23	68
Satisfactory (3)	12	16	14	42
Passed (4)	3	5	4	12
Failed (5)	0	0	0	0

Notes. *N* = 141; Group 1 *N* = 48; Group 2 *N* = 46; Group 3 *N* = 47; *Mdn* = median

<sup>a</sup> Austrian national grading scheme from 1 = *Excellent* to 5 = *Failed*

### 4.3.2. Teacher-assessed module assignment

The fifth research question of whether the perceived academic achievement of student groups mirrored the teacher-assessed module assignment was answered by means of descriptive statistics. Table 7 shows a median comparison and frequencies of grades awarded to students across all year groups. The median for all groups is the second-best grade in the Austrian national grading scheme (2.00), and none of the students failed the assignment, which equals good overall academic achievement.

### 4.3.3. Online recruitment advertisements

Students in the sample ( $N = 141$ ) had predominantly selected vacancies offered by European and North American companies, with exceptional cases from other regions. Table 1 in the Appendix lists all employment advertisements that the three student year groups exploited for the module assignment (see Appendix). In Group 2, the missing values for the employment advertisements were rather high, as 13 students had not appended a printed copy to their set of application documents.

Table 10 The 20 most frequent words in the corpus of online recruitment advertisements

Rank	Word <sup>a</sup>	Characters	Frequency	%
1	job	3	1,046	3.46
2	engineer	8	556	1.84
3	jobs	4	465	1.54
4	design	6	306	1.01
5	engineering	11	293	0.97
6	experience	10	275	0.91
7	systems	7	271	0.90
8	aerospace	9	225	0.75
9	apply	5	180	0.60
10	quality	7	177	0.59
11	test	4	175	0.58
12	email	5	162	0.54
13	search	6	162	0.54
14	work	4	154	0.51
15	will	4	152	0.50
16	technical	9	144	0.48
17	avionics	8	143	0.47
18	support	7	141	0.47
19	company	7	139	0.46
20	requirements	12	134	0.44

Notes.  $N = 80$  documents; 30,216 words in total; 3,815 words in results list

<sup>a</sup>Stop list in MAXDictio applied: personal pronouns, prepositions, articles, numbers, names of persons, acronyms, non-words, faulty words without spacing and combinations of symbols excluded from analysis; minimum number of characters for single word: 3

The qualitative content analysis of online employment advertisements ( $N = 80$ ) resulted in 21 codes and 3,209 coded segments. Table 2 in the Appendix presents the code system and frequency counts in each code category. The three main code categories were *Employment details* (with six sub-codes), *Industry requirements* (with six sub-codes) and *Specialist content* (with six sub-codes). The code system and the coded segments revealed insights into industry demands on aeronautical engineers as well as linguistic needs of engineering students. Furthermore,

the word frequencies in the corpus were determined with MAXDictio, an extension of MAXQDAplus® (Version 11, 1989/2012). The outcome of this examination was a ranked word list with the 20 most frequent items depicted in Table 10. These analyses answered the sixth research question by confirming that online employment advertisements serve as appropriate input for raising students' awareness of subject-specific content and specialist language in aeronautical engineering.

#### 4.4. Discussion

The triangulation of methods increased the objectivity of this research. The quantitative student survey, the teacher-assessed module assignment and the qualitative content analysis of online recruitment advertisements yielded rich data on the module's effectiveness from different angles. Another factor strengthening the study's objectivity is the clear design of the questionnaire instrument and its description in Section 4.2.1.2., which permits the replicability of the survey by other researchers.

The results obtained from this study are reliable because the same survey instrument produced comparable data through repeated gathering in three consecutive years. The survey's internal validity can be considered solid, with a good Cronbach alpha value of .766, which means that the instrument measures what it is supposed to measure. A potential threat to the internal validity may have been the inherent bias from a teacher-student relationship, as the researcher was also the teacher of the participants, yet the survey data had been acquired before students received their grades on the written module assignment to rule out a reverse grading effect. The external validity is also strong, even though the findings cannot be generalised in the manner of an inferential statistics design. Nevertheless, the sample investigated allows conclusions about both the partial population of aeronautics students in the author's institution and the global target population of aeronautical engineering students.

##### 4.4.1. Differences in the ratings of content and language items

The non-parametric Friedman test of all Likert-scale variables and the total sample ( $N = 141$ ) yielded significantly different mean ranks, so that the null hypothesis of equal medians across all items was rejected (Tables 2 and 3). The mean rank comparison of the content items in Table 4 showed that *Raised awareness of own educational needs* had been ranked highest (3.21), followed by *Strengthened motivation to study aviation* (3.12) and *Orientation concerning aerospace industry's demands* (3.06). These results suggest that the module under scrutiny alerted students to their educational needs and the aerospace industry's workplace

realities. Such an anchoring of language tuition in industry content also seems to produce motivational benefits for students. The fact that the mean rank of *Industry insights in authentic learning environment* (2.63) lay clearly below the median may be attributed to students' perception of a classroom setting as non-authentic compared to an industry setting. The mean rank comparison of language items in Table 5 showed that *Preparation for writing application and CV in aerospace* ranked highest (4.04), which indicates that the module under scrutiny was very effective in this respect. The second-highest language ranking of *Improved vocabulary knowledge of aviation and recruitment* (3.15) further supports the module's design and rationale to expand students' specialist lexical repertoire through online recruitment advertisements. Obviously, the module does not only boost motivation to study aeronautical engineering but also to learn English (3.13). In sum, there are differences in the ratings of content and language items by students, which answers the first research question.

#### 4.4.2. Differences in the perceived academic achievement

The Kruskal-Wallis test performed on the three student samples showed different ratings only for the item *Industry insights in authentic learning environment* ( $p = .043^*$ ), with the lowest mean rank for Group 1 (59.73) and the highest one for Group 3 (78.05). This shows that all three student samples judged their academic achievement equally and that the module did not alter students' impressions of its pedagogic value from one sample to the other over the three years under scrutiny. This constant learner recognition of content and language improvements supports conclusions about the module's didactic accomplishments. Interestingly, the item with the greatest variation of ratings as determined by the Kruskal-Wallis test also received the overall lowest mean rank in the Friedman comparison of content items, thus identifying it as the most controversial one among students in this category. As intimated above, this may be due to students' diverging understandings of the term *authentic*, which for some may be no acceptable designation of a language classroom. The second research question, therefore, yielded no significant differences in the perceived academic achievement across the three student samples.

#### 4.4.3. Correlations between content and language items

The Spearman's rho correlations between content and language items on the questionnaire suggest that industry-related variables correlate significantly with others (Table 6). The first variable, *Introduction to aeronautical engineering and aviation*, for instance, correlated significantly at the  $p \leq .01$  level (2-tailed) with

all other variables on learning gain about the aeronautical industry and on all language skills variables. This may hint at a reciprocal influence of content and language learning when subject-matter input and specific context are linked with tasks and activities for linguistic improvement. The second variable, *Orientation concerning aerospace industry's demands*, and the third variable, *Industry insights in authentic learning environment*, correlated in a comparable pattern as the first variable to the other content variables, with the exception that there was a weaker or no correlation with the variables *Raised awareness of own educational needs* and *Strengthened motivation to study aviation*. The second and third variables displayed similar results in the language field, where they correlated significantly at the  $p \leq .01$  level (2-tailed) with Variables 6 to 8, but only at the  $p \leq .05$  level (2-tailed) or not at all with the variable *Preparation for writing application and CV in aerospace* and the variable *Strengthened motivation to learn English*. These results allow for the interpretation that industry-oriented items influence each other as well as certain aspects of language improvement, such as vocabulary learning (Variable 6), spoken interaction skills (Variable 7) and reading skills (Variable 8).

The fact that industry insights in an authentic learning environment (Variable 3) yielded no significant correlation with writing preparation (Variable 9) may indicate that writing preparation requires specific linguistic support instead of a focus on authenticity. This is particularly surprising for the writing assignment in this module, as for producing a letter of application and a curriculum vitae, a stronger relationship between industry demands and the writing task had been expected. It needs to be remembered that these variables reflect the perceived ratings of students and no measured metrical data, which may also reveal a certain reservation of engineering students towards writing tasks. Furthermore, the genre of online employment advertisements as a lens for *Gaining industry insights in an authentic learning environment* may have correlated with aviation-related reading improvement because this type of input materials fostered visual intake. The fourth variable, *Raised awareness of own educational needs*, on the other hand, only displayed a strong correlation at the  $p \leq .01$  level (2-tailed) with Variables 9 and 10. This may point to an interrelationship between awareness-raising task components, personalised writing tasks and motivation, which would support the module design of moving from online vacancies as resources to the production of application documents by students. The fifth variable, *Strengthened motivation to study aviation*, was strongly related at the  $p \leq .01$  level (2-tailed) to Variables 8 to 10 only, which may indicate that the motivation to study subject matter is linked with the motivation to study language. Furthermore, it may suggest that the motivation to study aviation is connected with reading as well as writing improvement in an aeronautical context.

In the field of language, the sixth variable, *Improved vocabulary knowledge of aviation and recruitment*, correlated significantly at the  $p \leq .01$  level (2-tailed) with Variables 7 and 8, thus indicating a mutual influence between vocabulary learning on the one hand and spoken interaction as well as reading skills on the other. Surprisingly, no such correlation was found for the variable *Preparation for writing application and CV in aerospace*, even though the online recruitment advertisements contained a rich selection of subject-specific terms and phrases. Students may have felt that this writing task required more personalised than aviation-related or recruitment vocabulary. The seventh variable, *Improved aviation-related spoken interaction skills*, displayed a strong correlation at the  $p \leq .01$  level (2-tailed) with Variable 8, *Improved aviation-related reading skills*, which may stem from the succession of speaking and reading periods in the module's group exploration phase of online recruitment advertisements. The eighth variable further correlated strongly with Variable 9, *Preparation for writing application and CV in aerospace*, and with Variable 10, *Strengthened motivation to learn English*. In other words, there seems to be a reciprocal influence of improved reading skills and the preparation of the module assignment, which points to an important role of the right input materials in ESP and ICLHE. Furthermore, improved reading skills may strengthen the motivation to learn English, and a strong motivation may contribute to the development of reading skills. Variable 9 also correlated significantly at the  $p \leq .01$  level (2-tailed) with Variable 10, which means that the preparation of the module assignment was strongly linked with the motivation to learn English.

#### 4.4.4. Free verbal student feedback from the questionnaire

The free verbal student feedback from the questionnaire contained several areas that supported the results from the teacher-assessed module assignment. Students, for instance, found that the module had prepared them for seeking future employment, as it "was good to see which types of engineers the aeronautic industry is looking for." Several learners emphasised that the module had expanded their "technical English," "aeronautical vocabulary" and "business vocabulary." For participants it was also "interesting to use real material and advertisements from the internet." Concerning task integration, there were comments such as "good exercise" or "appreciate all related tasks," and learners "enjoyed solving the task in a group." Moreover, students had been encouraged to reflect on "personal skills . . . and compare them with the needs of different jobs." One student also mentioned the module's "good mix of theoretical and practical education," and several pointed to their increased "motivation to learn English, so [they] can also work abroad." Highly relevant practice has been identified as part

of an effective pedagogy in bilingual education (García & Baetens Beardsmore, 2009, p. 327). In short, learners in all three samples overwhelmingly addressed the module's suitability and validity for ESP, personal learning gains they had derived from its completion and a general appreciation of combining practical or industry aspects with language instruction in classroom settings.

#### 4.4.5. Teacher-assessed module assignment

The results from the teacher-assessed module assignment were corroborated by the free verbal student feedback from the questionnaire, which pointed to a recognition of the module's contribution to language learning progress. The grades from the module assignment (Table 7) also mirrored the longitudinally stable outcome concerning the perceived academic achievement of the different student groups over the three years under investigation which had been estimated by means of a Kruskal-Wallis test, thus answering the fifth research question. The fact that the median for all groups was the second-best grade in the Austrian national grading scheme (2.00) substantiated learners' ratings of the 10 survey items concerning their perceived academic progress (Tables 4 and 5). In other words, teacher assessment and student perceptions agreed in their detection of content and language learning success owing to the completion of the module.

#### 4.4.6. Online recruitment advertisements

The qualitative content analysis of online employment advertisements ( $N = 80$ ) with MAXQDAplus® (Version 11, 1989/2012) confirmed that this text type provides appropriate input for promoting students' understanding of industry requirements and subject-specific language in aeronautical engineering. The code system and the coded segments (Appendix, Table 2) allowed insights into workplace demands on aeronautical engineers in many respects. Selected retrievals from the corpus of recruitment advertisements characterise this text type's content and language focus and thus demonstrate its suitability for ESP didactics.

The texts analysed covered employment details including travel arrangements, working hours, benefits, salary ranges and restrictions. One advertisement, for instance, required the "mobility to relocate to South East Asia" from potential candidates, and another stipulated that future employees had to "work overtime, shift work (nights) or extended shifts, weekends and holidays as needed." The benefits mentioned were not limited to remuneration aspects but referred to immaterial advantages as well, as in the case of "a rare aviation industry chance to work a type design project that offers career and technical growth." Restrictions often confined the circle of candidates in terms of citizenship, work

permits or security clearances but also addressed particular necessities, such as a willingness and ability “to work in a clean room environment, full clean room suit with full face mask.”

The code category *Industry requirements* included sub-codes and details on personality, experience, communication skills, management skills, STEM skills as well as education and training. Communication skills mentioned were “technical writing, including reports and work instructions,” “documenting validation and qualification testing of new designs,” “writing design briefs,” “preparing bid proposals” or “mentoring small groups.” In short, the requirement of “excellent oral and written communication skills” featured prominently in the corpus. Management skills were also expected and comprised the ability to “drive schedule execution for a project, including recovery and work around plans” or “strength in planning, time management, and organization.” Retrieved STEM skills addressed the “generation of 3D CAD models and 2D manufacturing drawings,” an “aptitude for math and complex equations (incl. probability and statistics)” or an “understanding of device physics and failure modes.”

Specialist content in the corpus focused on processes, products, tasks, sectors, software and hardware common in the aeronautics industry. The crucial role that machines, instrumentation and test procedures play for engineers has been noted before (Winsor, 1998, p. 353). However, content is expressed through language, which implies a strong natural link between these cognitive concepts (Stohler, 2006). These selected retrievals indeed identify the text type of online employment advertisements as a rich source of technical, workplace-oriented and recruitment language.

## 5. Conclusions

The effectiveness of the teaching module under scrutiny was confirmed by results from triangulated quantitative and qualitative research methods. The findings related to the module pointed to a strong recognition as well as good academic achievement among students. Even though Quick (2012) called job-application materials and cover letters a “culminating genre, not an introductory one” (p. 248), the results of this research support the decision to introduce this teaching module at the beginning of an ESP stream for engineering students. Apart from linguistic gains, an early introduction of learners to their future career fields may yield benefits such as a motivation “to work toward longer-term goals,” guidance on “informed choices about their own careers” and preparation for the engineering workplace (Chalifoux & Vinet, 1988, p. 308).

Weaknesses of this study are its limited generalisability in strictly inferential statistical terms and its author’s double role of teacher-researcher. Nevertheless,

the aerospace sector is a truly global industry, which imposes similar and thus comparable demands on engineers, as the qualitative content analysis of online recruitment advertisements has indicated. In this context, it is legitimate to assume that the module's effectiveness as perceived by participants in the current study would be rated similarly by aeronautical engineering students in other institutions. Furthermore, it is true that the teacher-researcher role prevented randomised participant sampling, yet it enabled the analysis of content and language integrated ESP instruction from a practitioner perspective. Such practitioner research may add valuable insights into the field, as it reveals immediate classroom concerns. In short, integrating content and language through online employment advertisements represents a feasible and effective basis for teaching ESP.

### Acknowledgements

I would like to thank all student cohorts for their informed participation in this study and the two anonymous reviewers of the manuscript version for their valuable comments and suggestions for improvement. I am also indebted to the journal editor for his guidance during the review and publication phases.

References

- Abello-Contesse, C. (2013). Bilingual and multilingual education: An overview of the field. In C. Abello-Contesse, P. M. Chandler, M. D. López-Jiménez, & R. Chacón-Beltrán (Eds.), *Bilingual and multilingual education in the 21st century: Building on experience* (pp. 3-23). Bristol, UK: Multilingual Matters.
- Ament, J. R., & Pérez-Vidal, C. (2015). Linguistic outcomes of English-medium instruction programmes in higher education: A study on economics undergraduates at a Catalan university. *Higher Learning Research Communications*, 5(1), 47-68. Retrieved from <http://www.hlrcjournal.com/index.php/HLRC/article/view/239/209>
- Baetens Beardsmore, H. (2009). Language promotion by European supra-national institutions. In O. García & H. Baetens Beardsmore, *Bilingual education in the 21st century: A global perspective* (pp. 197-217). Chichester, UK: Wiley-Blackwell.
- Brezina, V. (2012). Use of Google Scholar in corpus-driven EAP research. *Journal of English for Academic Purposes*, 11(4), 319-331. <http://dx.doi.org/10.1016/j.jeap.2012.08.001>
- Brinton, D. M., Snow, M. A., & Wesche, M. (2003). *Content-based second language instruction* (Michigan Classics ed.). Ann Arbor, MI: The University of Michigan Press. (Original work published 1989)
- British Educational Research Association (BERA). (2011). *Ethical guidelines for educational research*. London, UK: BERA. Retrieved from <https://www.bera.ac.uk/wp-content/uploads/2014/02/BERA-Ethical-Guidelines-2011.pdf>
- Bruton, A. (2011). Is CLIL so beneficial, or just selective? Re-evaluating some of the research. *System*, 39(4), 523-532. <http://dx.doi.org/10.1016/j.system.2011.08.002>
- Carrió Pastor, M., & Gimeno Sanz, A. (2007). Content and language integrated learning in a technical higher education environment. In D. Marsh & D. Wolff (Eds.), *Diverse contexts – Converging goals: CLIL in Europe* (pp. 103-111). Frankfurt/Main: Peter Lang.
- CBI Higher Education Task Force. (2009). *Stronger together: Businesses and universities in turbulent times* (Report). Retrieved from [http://195.88.100.72/resource/files/2010/01/11/CBI\\_HE\\_taskforce\\_report.pdf](http://195.88.100.72/resource/files/2010/01/11/CBI_HE_taskforce_report.pdf)
- Chalifoux, J.-P., & Vinet, R. (1988). Engineering project design and communication skills. *Engineering Education*, 77, 308-310.
- Charles, M. (2012). "Proper vocabulary and juicy collocations": EAP students evaluate do-it-yourself corpus-building. *English for Specific Purposes*, 31(2), 93-102. <http://dx.doi.org/10.1016/j.esp.2011.12.003>

- Coleman, J. A. (2012). Non-specialist linguists in the United Kingdom in the context of the Englishisation of European higher education. *Fremdsprachen Lehren und Lernen*, 41(2), 9-24.
- Costa, F. (2012). Focus on form in ICLHE lectures in Italy: Evidence from English-medium science lectures by native speakers of Italian. *AILA Review*, 25, 30-47. <http://dx.doi.org/10.1075/aila.25.03cos>
- Crystal, D. (2003). *English as a global language* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Doiz, A., Lasagabaster, D., & Sierra, J. M. (2013). Future challenges for English-medium instruction at the tertiary level. In A. Doiz, D. Lasagabaster, & J. M. Sierra (Eds.), *English-medium instruction at universities: Global challenges* (pp. 213-221). Bristol, UK: Multilingual Matters.
- Duensing, A., & Batstone, C. (2004). The integration of language, ICT and web skills as a vehicle for student-centred learning. In R. Wilkinson (Ed.), *Integrating content and language: Meeting the challenge of a multilingual higher education: Proceedings of the ICL Conference, October 23-25 2003* (pp. 229-241). Maastricht: Universitaire Pers Maastricht.
- Engineering Council. (2004/2010). *The accreditation of higher education programmes: UK standard for professional engineering competence* [Brochure]. Retrieved from <http://www.engc.org.uk/ecukdocuments/internet/document%20library/AHEP%20Brochure.pdf>
- Foran-Storer, D. (2007). Teaching technical English at the tertiary and professional level: Content-based cooperative learning under the CLIL umbrella. In D. Marsh & D. Wolff (Eds.), *Diverse contexts – Converging goals: CLIL in Europe* (pp. 309-317). Frankfurt/Main: Peter Lang.
- Fürstenberg, U., & Kletzenbauer, P. (2012). CLIL: From online sources to learning resources. In Pixel (Ed.), *Conference Proceedings: International Conference ICT for Language Learning* (5th Conference Edition, pp. 25-29). Padova: libreriauniversitaria.it. Retrieved from [http://conference.pixel-online.net/ICT4LL2012/common/download/Paper\\_pdf/149-CLIO2-FP-Kletzenbauer-ICT2012.pdf](http://conference.pixel-online.net/ICT4LL2012/common/download/Paper_pdf/149-CLIO2-FP-Kletzenbauer-ICT2012.pdf)
- García, O., & Baetens Beardsmore, H. (2009). *Bilingual education in the 21st century: A global perspective*. Chichester, UK: Wiley-Blackwell.
- Greere, A., & Räsänen, A. (2008). *LANQUA subproject on content and language integrated learning: Redefining "CLIL" – Towards multilingual competence* (Year One Report). Retrieved from [http://www.lanqua.eu/sites/default/files/Year1Report\\_CLIL\\_ForUpload\\_WithoutAppendices\\_0.pdf](http://www.lanqua.eu/sites/default/files/Year1Report_CLIL_ForUpload_WithoutAppendices_0.pdf)
- Jenkins, J. (2007). *English as a lingua franca: Attitude and identity*. Oxford, UK: Oxford University Press.

- Kasper, L. F. (2000a). The internet and content-based college ESL instruction: Reading, writing, and research. In L. F. Kasper (Ed.), *Content-based college ESL instruction* (pp. 183-201). Mahwah, NJ: Lawrence Erlbaum Associates.
- Kasper, L. F. (2000b). The role of information technology in the future of content-based ESL instruction. In L. F. Kasper (Ed.), *Content-based college ESL instruction* (pp. 202-212). Mahwah, NJ: Lawrence Erlbaum Associates.
- Kwary, D. A. (2011). A hybrid method for determining technical vocabulary. *System*, 39(2), 175-185. <http://dx.doi.org/10.1016/j.system.2011.04.003>
- Lamb, F., Arlett, C., Dales, R., Ditchfield, B., Parkin, B., & Wakeham, W. (2010). *Engineering graduates for industry* (Report by the Royal Academy of Engineering). Retrieved from [http://www.raeng.org.uk/education/scet/pdf/Engineering\\_graduates\\_for\\_industry\\_report.pdf](http://www.raeng.org.uk/education/scet/pdf/Engineering_graduates_for_industry_report.pdf)
- Littlejohn, A., & Hicks, D. (1987). Task-centred writing activities. In C. N. Candlin & D. Murphy (Eds.), *Language learning tasks* (pp. 69-91). Englewood Cliffs, NJ: Prentice-Hall International.
- Llinares, A., Morton, T., & Whittaker, R. (2012). *The roles of language in CLIL*. Cambridge, UK: Cambridge University Press.
- Luzón Marco, M. J., & González Pueyo, M. I. (2006). Using the internet to promote autonomous learning in ESP. In E. Arnó Macià, A. Soler Cervera, & C. Rueda Ramos (Eds.), *Information technology in languages for specific purposes: Issues and prospects* (pp. 177-190). New York, NY: Springer Science & Business Media.
- Marsh, D., Pavón Vázquez, V., & Frigols Martín, M. J. (2013). *The higher education languages landscape: Ensuring quality in English language degree programmes*. Valencia: Design and Multimedia Contents Department, Valencian International University (VIU).
- MAXQDAplus® (Version 11, Release 11.0.11) [Computer software]. (1989/2012). Berlin: VERBI® Software.Consult.Sozialforschung.
- Met, M. (1999). *Content-based instruction: Defining terms, making decisions* (NFLC Report). Washington, DC: The National Foreign Language Center. Retrieved from <http://www.carla.umn.edu/cobal/tt/modules/principles/decisions.html>
- Paran, A. (2010, April). *ELT Journal*/IATEFL debate: Content and language – An illusion? Opponent to Sheelagh Deller in the debate at the 44th IATEFL Annual Conference and Exhibition, Harrogate, UK.
- Paran, A. (2013). Content and language integrated learning: Panacea or policy borrowing myth? *Applied Linguistics Review*, 4(2), 317-342. <http://dx.doi.org/10.1515/appliv-2013-0014>
- Prodromou, L. (2008). *English as a lingua franca: A corpus-based analysis*. London, UK: Continuum.
- Quick, C. (2012). From the workplace to academia: Nontraditional students and the relevance of workplace experience in technical writing pedagogy.

- Technical Communication Quarterly*, 21(3), 230-250. <http://dx.doi.org/10.1080/10572252.2012.666639>
- Räisänen, C., & Fortanet-Gómez, I. (2008). The state of ESP teaching and learning in Western European higher education after Bologna. In I. Fortanet-Gómez & C. Räisänen (Eds.), *ESP in European higher education: Integrating language and content* (pp. 11-51). Amsterdam: John Benjamins.
- The Royal Academy of Engineering. (2007). *Educating engineers for the 21st century* (Research Report). Retrieved from [http://www.raeng.org.uk/news/publications/list/reports/Educating\\_Engineers\\_21st\\_Century.pdf](http://www.raeng.org.uk/news/publications/list/reports/Educating_Engineers_21st_Century.pdf)
- Seidlhofer, B. (2001). *English: Native tongue, foreign language, lingua franca: An applied linguistic enquiry* (Unpublished habilitation). University of Vienna, Austria.
- Smit, U., & Dafouz, E. (2012). Integrating content and language in higher education: An introduction to English-medium policies, conceptual issues and research practices across Europe. *AILA Review*, 25, 1-12. <http://dx.doi.org/10.1075/aila.25.01smi>
- Snow, M. A., & Brinton, D. M. (1988). Content-based language instruction: Investigating the effectiveness of the adjunct model. *TESOL Quarterly*, 22(4), 553-574.
- Snow, M. A., Met, M., & Genesee, F. (1989). A conceptual framework for the integration of language and content in second/foreign language instruction. *TESOL Quarterly*, 23(2), 201-217.
- SPSS® Statistics (Version 22) [Computer software]. (1989/2013). Armonk, NY: IBM®.
- Stohler, U. (2006). The acquisition of knowledge in bilingual learning: An empirical study on the role of language in content learning. *VIEWES: Vienna English Working Papers*, 15(3), 41-46. Retrieved from <http://anglistik.univie.ac.at/views/archive/>
- Studer, P., Pelli-Ehrensperger, A., & Kelly, P. (2009). *Mehrsprachigkeit an universitären Bildungsinstitutionen: Arbeitssprache Englisch im Hochschulfachunterricht*. Winterthur: Institut für Sprache in Beruf und Bildung, Departement für Angewandte Linguistik, ZHAW Zürcher Hochschule für Angewandte Wissenschaften. Retrieved from <http://pd.zhaw.ch/hop/1222889142.pdf>
- Tatzl, D. (2011a). English-medium masters' programmes at an Austrian university of applied sciences: Attitudes, experiences and challenges. *Journal of English for Academic Purposes*, 10(4), 252-270. <http://dx.doi.org/10.1016/j.jeap.2011.08.003>
- Tatzl, D. (2011b). Vacancies and employment profiles in the aerospace industry: Content and language integrated learning through the internet. In Pixel (Ed.), *International Conference ICT for Language Learning: Conference Proceedings* (4th Conference Edition, p. 13). Milano: Simonelli Editore. Abstract book, full paper retrieved from [http://www.pixel-online.net/ICT4LL2011/common/download/Paper\\_pdf/CLIL02-133-FP-Tatzl-ICT4LL2011.pdf](http://www.pixel-online.net/ICT4LL2011/common/download/Paper_pdf/CLIL02-133-FP-Tatzl-ICT4LL2011.pdf)

- Tatzl, D. (2015a). Case meetings for teaching English for specific academic purposes in a tertiary aeronautical engineering programme. *Innovation in Language Learning and Teaching*, 9(3), 191-217. <http://dx.doi.org/10.1080/17501229.2014.904871>
- Tatzl, D. (2015b). A constructionist English language teaching project based on an aeronautical conceptual design challenge. *Technical Communication*, 62(1), 29-47. Retrieved from <http://techcomm.stc.org/2015/04/a-constructionist-english-language-teaching-project-based-on-an-aeronautical-conceptual-design-challenge/>
- Tatzl, D., Hassler, W., Messnarz, B., & Flühr, H. (2012). The development of a project-based collaborative technical writing model founded on learner feedback in a tertiary aeronautical engineering program. *Journal of Technical Writing and Communication*, 42(3), 279-304.
- Tedick, D. J., & Cammarata, L. (2012). Content and language integration in K-12 contexts: Student outcomes, teacher practices, and stakeholder perspectives. *Foreign Language Annals*, 45(1), 28-53. <http://dx.doi.org/10.1111/j.1944-9720.2012.01178.x>
- Unterberger, B., & Wilhelmer, N. (2011). English-medium education in economics and business studies: Capturing the status quo at Austrian universities. *International Journal of Applied Linguistics*, 16(1), 90-110.
- Wilkinson, R. (2003). Domain-specific writing: Acquiring expertise in psychology writing. In C. Van Leeuwen & R. Wilkinson (Eds.), *Multilingual approaches in university education: Challenges and practices* (pp. 163-185). Nijmegen: Uitgeverij Valkhof Pers & Talencentrum Universiteit Maastricht.
- Winsor, D. A. (1998). Rhetorical practices in technical work. *Journal of Business and Technical Communication*, 12(3), 343-370.

APPENDIX

Qualitative results from the analysis of online employment advertisements

Table 1 Employment advertisements chosen by students for module assignment from 2012 to 2014

Group 1 <sup>a</sup>	Company <sup>d</sup>	Frequency
• Aerodynamics Engineer (Stability & Control) Level 1	Boeing, USA	1
• Aerospace Design Engineer	iNTECH Recruitment Ltd, UK	2
• Aircraft Technician – Wheels & Brakes	Emirates Group, Dubai	1
• Design Engineer	Bishop GmbH, Germany FACC AG, Austria s.com Aviation, UK	3
• Electronic Maintainability and Diagnostic Engineer	Bishop GmbH, Germany	2
• Electronics Engineer – Avionics	Schiebel GmbH, Austria	1
• Engineering Internship Job	GE Aviation, USA	1
• Engineering Landing Gear Systems Internship	EADS, N.V., The Netherlands	1
• Engineers and Technicians	EADS, N.V., The Netherlands	1
• Fuel System & Engine Installation Development Engineer	EADS, N.V., The Netherlands	1
• Galley Development Engineer – Structures Engineer – Design Engineer	Employment agency	1
• IFE Maintenance Service Representatives – Australia and Hong Kong	Jet Professionals LLC, USA	1
• Internship	AVL List GmbH, Austria Dassault Aviation S.A., France EADS, N.V., The Netherlands Lufthansa Group, Germany	4
• Internship / Thermal Optimisation of Pylon	EADS, N.V., The Netherlands	1
• Internship / Tool Development / Flight Control Computers A350	EADS, N.V., The Netherlands	1
• Internship within Engineering: Planning & Performance Management	EADS, N.V., The Netherlands	1
• Intern, Ground Operations	IATA, Canada	1
• Intern – Student Engineer	Boeing, USA	1
• Mechanical/Structural Design Engineer	Protec Technical Ltd, UK	1
• New Product Introduction (NPI) Engineer	Vector Aerospace Corporation, Canada	1
• Performance Engineer	Morson Group, UK	1
• Production Planner	Omega Resource Group Ltd, UK	1
• Programme Intern – Engineering – Stress/Mechanical	Rolls-Royce plc, UK	1
• Safety Response Specialist	Etihad Airways, UAE	1
• Software Engineer	Matchtech® Group plc, UK	1
• Stress Engineer	Bishop GmbH, Germany Matchtech® Group plc, UK	2
• Structures Engineer	Morson Group, UK	1
• Summer Internship – Industrial Engineering	Bell Helicopter Textron Inc., USA	1
• System Engineer for Advanced Air System Architectures	EADS, N.V., The Netherlands	1
• Systems Analyst / Flight Physics / Performance Engineer	Experis™, USA	1
• Systems Engineer (Aerospace/Avionics)	Experis™, USA	1
• Systems Engineer – Avionics	Employment agency	1
• Technical Engineer	Employment agency	2
• Weights Engineer	Capital Group, UK	1

Group 2 <sup>b</sup>	Company <sup>d</sup>	Frequency
• Aero Design Engineer	GE Aviation, USA	1
• Aeronautics Mechanical Engineer	Leidos Inc., USA	1
• Applications & Design Engineer	Rexnord® Corporation, USA	1
• Avionic Design Engineer	Aeropeople Ltd, UK	1
• Avionics Design Engineer	Zenon Recruitment Ltd, UK	2
• Avionics Engineer – Bombardier/Gulfstream	Employment agency	1
• Avionics Lead Software Engineer – Flight Management Systems	GE Aviation, USA	1
• CAD & Documentation Engineer (Electrical Systems)	Matchtech® Group plc, UK	1
• Composite Manufacturing Design Engineer	Aeropeople Ltd, UK	2
• Design Engineer	Bishop GmbH, Germany Ferchau Engineering GmbH, Germany	5
• Design Engineer (Electrical/Avionic)	Aeropeople Ltd, UK	1
• Design Engineer – Turbomachinery	GE Aviation, USA	1
• Detailed Design Engineer	Bishop GmbH, Germany	1
• Electrical Test Engineer	Exelis Inc., USA	1
• Fuselage Aerodynamics Specialist	Morson Group, UK	1
• Ground Operations Manager	Zenon Recruitment Ltd, UK	1
• Internship at IATA	IATA, Canada	1
• Internship Campaign	EADS, N.V., The Netherlands	1
• Internship within Test Set-Up Preparation on the Secondary HC Structure	EADS, N.V., The Netherlands	1
• Maintenance Planner	Zenon Recruitment Ltd, UK	1
• Mechanical Engineer	Honeywell International Inc., USA	1
• Mechanical Engineer – Life Support	Cobham plc, UK	1
• Private Aviation Sales Leader	Zenon Recruitment Ltd, UK	1
• Propulsion Engineer Level 1	Boeing, USA	1
• Senior Avionic Design Engineer	Cobham plc, UK	1
• Systems Engineer	JAM Recruitment Ltd, UK	1
• UAS/UAV Assistant Professor	Middle Georgia State College, USA	1
Group 3 <sup>c</sup>	Company <sup>d</sup>	Frequency
• Aerospace Business Development Manager	DIAB Group, Sweden	1
• Aerospace Structures Design Engineer	Cobham plc, UK	1
• Associate Principal Systems Engineer	Exelis Inc., USA	1
• Aviation Services Manager	Zenon Recruitment Ltd, UK	1
• Avionics Designer	Intec Ltd, UK	2
• Avionics Engineer	Excel Technical Consulting Ltd, UK	1
• Cadet Pilot	Cathay Pacific Airways Ltd, Hong Kong	1
• Cargo Route Research and Business Intelligence Manager	Emirates Group, Dubai	1
• Chief Designer	Aeropeople Ltd, UK	1
• Composite Design Engineer	Excel Technical Consulting Ltd, UK	2
• Composite Operator	Morson Group, UK	1
• Composite Stress Engineer	Employment agency, UK	1
• Customer Service Representative	Textron Inc., USA	1
• Customer Support Engineer	Panasonic Avionics Corporation, USA	1
• Development Engineer	Elevation Recruitment, UK	1
• Director-Flight Technical	Ryan Aviation Recruitment, Ireland	1
• Electrical Test Engineer	Exelis Inc., USA	1

• F-15 Analysis / Electrophysics Engineer 1/2	Boeing, USA	1
• Facilities Engineer	Aeropeople Ltd, UK	1
• Flight Data Monitoring & Investigation Officer	AirTanker Ltd, UK	1
• Flight Physics Engineer	Airbus S.A.S, France	1
• Flight Test Engineer	Bombardier Inc., Canada	1
• Graduate Mechanical Analysis Engineer	Airbus S.A.S, France	1
• Graduate Mechanical, Thermal & Propulsion Engineer	Airbus S.A.S, France	1
• Internship within Engineering: Virtual Helicopter Based on 3D CATIA® Data	Airbus S.A.S, France	1
• Maintenance Engineer	Ryanair Ltd, Ireland	1
• Program Planning & Control Intern	Boeing, USA	1
• Project Engineer	GE Aviation, USA Hays plc, UK	2
• Project Engineer – Cabin Interior	Emirates Group, Dubai	1
• Project Manager	Carbon60 Ltd, UK FACC Operations GmbH, Austria	2
• Propulsion Engineer 1\2	Boeing, USA	1
• Quality Manager	Oaklands Global Ltd, UK	1
• Senior Lead Manufacturing Engineer	Aurora Flight Sciences, USA	1
• Stress Engineer	Bishop GmbH, Germany Strongfield Aviation plc, UK	5
• Structural Design Engineer	Aeropeople Ltd, UK	1
• Test Engineer	Exelis Inc., USA	1
• Trainee Composite Production Assistant	Employment agency, UK	1

Notes. N = 141; Group 1 n = 48; Group 2 n = 46; Group 3 n = 47

<sup>a</sup> Missing copies of employment advertisements: n = 5; <sup>b</sup> missing copies: n = 13; <sup>c</sup> missing copies: n = 2

<sup>d</sup> Location of headquarters; several of these companies are employment agencies and professional recruiters

Table 2 Results from the qualitative content analysis concerning online recruitment advertisements in MAXQDAplus® (Version 11, 1989/2012)

Code system			
Code	Definition	Example <sup>a</sup>	Frequency <sup>b</sup>
Employment details	Specific information on position advertised that is not part of any sub-code	All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability or protected veteran status. [B/E Aerospace, Inc., Doc. No. 57]	173
Position title	Title of position advertised	Manufacturing Composite Engineer [CPI Radant Technologies Division, Doc. No. 01]	274
Travel	Mobility demands of the position	Willing to travel, up to 50% of time, with extended stays nationally and/or internationally as needed [Exelis Inc., Doc. No. 05]	23
Working hours	Hours of work per day or week, including contract type	flexibility to adjust work hours and schedule [MasterWorks, Inc., Doc. No. 14]	133
Benefits	Pension schemes, holidays or other details except salary	25 days holiday + 8 bank holiday [Fircroft Group, Doc. No. 16]	43
Salary	Exact figures or qualitative notes	Salary £25,000 - £40,000 Depending on experience [Lamonby Recruitment, Doc. No. 28]	76
Restrictions	Limitations for candidates	U.S. citizen or permanent resident [CPI Radant Technologies Division, Doc. No. 01]	69

Industry requirements	Specific information on industry demands that is not part of any sub-code	no colour blindness [Carbon60 Ltd, Doc. No. 49]	7
Personality	Personal character and traits	High level of personal integrity [Strongfield Aviation plc, Doc. No. 63]	78
Experience	Number of years and practical experience of performing a certain task	five to ten years of industry experience [Boeing, Doc. No. 02]	177
Communication skills	Explicitly and implicitly named communication skills	Excellent oral and written communication skills of technical issues both internally and externally [Exelis Inc., Doc. No. 04]	183
Management skills	Any skills related to organisation, management, leadership and project delivery	Manages technical operation flow of a large project/program [Exelis Inc., Doc. No. 04]	118
STEM skills	Knowledge and skills in science, technology, engineering and mathematics	Uses the application of systems engineering standards, principles, theories, concepts and techniques. [Exelis Inc., Doc. No. 06]	336
Education & training	Specified qualification of candidates with level	Bachelor of Science Degree in engineering or related technical discipline [Exelis Inc., Doc. No. 04]	120
Specialist content	Specific technical terms that are not part of any sub-code	fabricated and machined parts [Sigma Recruitment, Doc. No. 30]	22
Processes	Principal global processes and work descriptions	Provides engineering and engineering support services to a variety of technical problems of moderate scope and complexity [Exelis Inc., Doc. No. 05]	183
Products	Technical products or services related to the position	turbine components [Fircroft Group, Doc. No. 16]	161
Tasks	Specific tasks involved in the workplace description	creates/manages electronic test data [Exelis Inc., Doc. No. 05]	382
Sector	Scientific field or market segment	composite aerostructures [Exelis Inc., Doc. No. 06]	501
Software	Computer-aided design and analysis tools and programming languages	coding in C and C++ [Get Computer Systems Analyst Jobs, Doc. No. 56]	96
Hardware	Machines, equipment and tools in the workplace	flight simulators [Get Marine Engineering Jobs, Doc. No. 51]	54

*Notes.*  $N = 80$  documents as advertised in January 2015 in the corpus;  $N = 21$  codes (*Employment details*:  $n = 7$ ; *Industry requirements*:  $n = 7$ ; *Specialist content*:  $n = 7$ );  $N = 3,209$  coded segments

<sup>a</sup> Original wording, spelling and capitalisation; names of companies or employment agencies advertising the positions and the corresponding document numbers from the corpus are given in square brackets

<sup>b</sup> Relates to number of coded segments in each code category