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Helping Students from Different Disciplines with their Final Year/Capstone Project Supervisors' and Students' Needs and Requests

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Helping Students from Different Disciplines with their Final Year/ Capstone Project: Supervisors' and Students' Needs and Requests

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Abstract: A capstone project (CP) demands mastery of a broad range of skills, such as formulating research questions, synthesizing and cross-referencing previous literature with current findings, and writing up the study in the longest report students have probably ever written. The study reported in this chapter is part of a government-funded five-university project on co-developing a mobile app for supporting CP writing in various disciplines. This project is grounded in the belief that the ubiquitous and interactive nature of mobile learning could enrich learning and supervision experience (Källkvist et al., 2009), which in turn would lead to higher student satisfaction (Del Río et al., 2018). To develop a mobile app that helps supervisors and students, a dual-method approach was employed to gather both subjective and objective stakeholder feedback data via focus group interviews and by analysing CP reports from three disciplines to reveal common writing problems (Flowerdew, 2018). Results show that the introduction section,

the literature review and the discussion sections, research mapping, and referencing are four major areas of concern.

Keywords: English across the curriculum, capstone project, mobile app, student needs, textual analysis

One key feature of the new four-year undergraduate curriculum in Hong Kong's tertiary education is the explicit requirement for a capstone project (CP) as a means to provide undergraduate students with a culminating experience that equips them with the employment proficiencies, such as problem-solving, presentation, and organizational skills (Cranmer, 2006; Washer, 2007; Zinser, 2003), needed for a knowledge-based society (Education Commission, 2000). Research has shown that at least four factors are important for the successful completion of the CP: quality supervision, good time management, strong communication skills, and affordances of technology. Supervision is largely a one-on-one activity that can be conducted on campus or in online settings (Jaldemark & Lindberg, 2013). Although supervision support for students varies across disciplines and supervisors, good quality supervisor-supervisee communication helps students reach CP milestones, such as setting suitable research objectives (Greenbank & Penketh, 2009). Good time management is the second key factor. Belinda Ho (2003) reports that students respond differently to the same time management advice given by their supervisors, and good planning is a key to completing a project on time. A further requirement for a successful CP is strong communication skills. Both first-language (L1) and second-language (L2) students "may be lacking in specialized reporting and English skills" and would benefit from a language intervention and enhancement program (Blicblau & Dini, 2012). The CP process can provide training in the language skills required in industries where students will find jobs; indeed, some students have reported "communication and presentation skills being improved" as part of their capstone experience (Thomas et al., 2014, p. 588).

The fourth factor relates to the affordances of technology. The last decade has witnessed an increasing number of studies on the use of technology for mediating capstone project supervision, largely due to the wide adoption of learning management systems. For example, Marie Källkvist and colleagues (2009) report student and supervisor satisfaction with virtual learning spaces and communication tools. The availability of digital tools increases the possibility for multimodal supervision, which can benefit from the employment of analytics to "give the 'big picture' of student engagement" (Stoneham & Essop, 2014, p. 5). Increased online interaction with supervisors can also lead to higher student satisfaction (Del Río et al., 2018).

Further advances should bring together these four factors in situations where technology is used to mediate and facilitate supervision, deliver core competencies and communication training, and enhance CP planning management, which is the aim of the current study.

Background

An examination of the background of Hong Kong university students can provide insight into their struggles during the CP writing process. An increasing number of Hong Kong university students come from CMI (Chinese as medium of instruction) schools as the number of EMI (English as medium of instruction) schools has dropped dramatically from 90 percent to 25 percent since 1997 (Evans & Green, 2007; Fan, 2001). The MOI (medium of instruction) fine-tuning policy has had a substantial bearing on university students' academic communication ability (Chen, 2020), which has become a primary concern for both students and academics (Littlewood & Liu, 1996), given the perceived need for fluent English to succeed academically in university (Hyland, 1997). Numerous studies have reported that CMI students, when compared with their EMI counterparts, generally demonstrate lower competence and confidence in English and encounter greater difficulties in understanding subject-specific vocabulary, writing academic texts (Evans & Morrison, 2011), articulating complex ideas in English grammatically (Evans & Green, 2007), and adjusting to the academic demands of their key study area (Evans & Morrison, 2018).

Despite the language needs of CMI students, the Hong Kong undergraduate curriculum leaves limited classroom contact hours for EGAP (English for general academic purposes) and ESAP (English for specific academic purposes) courses. This is especially the case in the sophomore and senior years in nearly all the government-funded institutions, as shown in Table 5.1.

EGAP training is essential for helping students “navigate their school-to-university transition and acculturation process” in English-medium universities (Chen, 2020, p. 119) and acquire academic skills such as argument structure, academic register, and referencing and citation in the freshman year. Recent studies have also noted the effectiveness of EGAP training in enhancing undergraduate students' general academic English skills. Evidence from Peter Crosthwaite's (2016) corpus-based study indicates that after one semester of EGAP training, students demonstrate significant improvement in the use of appropriate academic register, such as fewer first-person pronouns, more nominalizations, and better argument structure. Another study (Chen & Fong, 2017) adopted a learning analytics approach to com-

pare the academic writing of students whose university entry English scores were equivalent to International English Language Testing System (IELTS) 6.30-6.51 with that of students with a higher entry score (equivalent to IELTS 6.81-7.77). Results revealed encouraging improvement in the English proficiency level and referencing skills of the former group in comparison with the latter after 13 weeks of EGAP training.

Table 5.1. English courses offered by language centers in eight government-funded universities in Hong Kong

University	Year 1	Year 2	Year 3	Year 4
City University of Hong Kong (CityU)	3 credits EGAP 3 credits ESAP			
The Chinese University of Hong Kong (CUHK)	4 credits EGAP	3 credits ESAP	2 credits ESP	
The Education University of Hong Kong (EdUHK)	3 credits EGAP Writing 3 credits EGAP Speaking			
Hong Kong Baptist University (HKBU)	6 credits EGAP			
The University of Hong Kong (HKU)	6 credits EGAP	6 credits ESAP		
The Hong Kong University of Science and Technology (HKUST)	6 credits EGAP	3 credits ESAP	3 credits ESP	
Lingnan University (LU)	9 credits EGAP			
The Hong Kong Polytechnic University (PolyU)	6 credits EGAP	1-3 credits ESAP		

ESP – English for Specific Purposes

ESP/ESAP training, although deemed equally essential for success in students’ senior years, is valued very differently across Hong Kong universities. As presented in Table 5.1, half of the institutions do not offer English training beyond the freshman year, while the other half extend support for faculty-based discipline-specific English (ESP) and/or English for specific academic purposes (ESAP) in the sophomore and senior years. To address the scarcity of curriculum space for ESP/ESAP training and to provide sustainable campus-wide support for enhancing discipline-specific academic literacy, English Across the Curriculum (EAC) initiatives, supported by two government funds, were introduced in four of the eight Hong Kong uni-

versities in 2014 and one additional tertiary institution in 2017. One feature of EAC is the collaboration between English teachers and faculty staff to identify the competencies and skills required for successful completion of assignments in content courses, such as the writing of case study reports, capstone project dissertations, and critiques of professional practices (Chen, 2016). Accompanying language support services and resources, including writing consultations, writing templates, and online learning materials, are subsequently developed to supplement the lack of ESP/ESAP materials in the four-year curriculum.

Although EAC resources have been developed with one-off government and university funds, inadequate ESP/ESAP training and support have made the CP writing and supervisory process challenging for students and academics. Keith Thomas et al.'s (2014) study reports that students failed to apply what they learned in their university studies when preparing their CP dissertations, while academics felt that, due to heavy workload and pressure to publish, "being a project supervisor is not easy" (p. 590). Another concern expressed by supervisors relates to the paucity of materials available to support CP supervision. Other than departmental CP procedural documents, academics have no access to structured and clear guidelines on effective CP supervision (Roberts & Seaman, 2018).

One way to address the lack of ESP/ESAP provision in the curriculum and to enhance student and faculty engagement in the CP preparation process is to develop a mobile app which provides instant communication as well as ubiquitous and one-stop English language support for faculty staff and senior-year students. Studies with higher education students have shown that students prefer accessing the internet on mobile devices (Wong et al., 2015) and learning through bite-sized lectures (Koh et al., 2018). In contrast to language learning websites, mobile apps offer more personalized user experiences and foster students' active participation via the use of multimodal materials (Beach & O'Brien, 2014), progress-tracked exercises, and self-management tools. The CP app presented in this chapter, which aims to help students in various disciplines master a broad range of skills required for the successful completion of CP dissertations, is the first attempt to utilize mobile technology to address the gaps and language needs identified in the current delivery of CP in Hong Kong tertiary institutions.

Methodology

The development of a mobile app, called Capstone Ninja, for supporting CP report writing in various disciplines was the primary aim of a govern-

ment-funded project for five Hong Kong universities. In order to develop such an app that addresses the needs of both CP supervisors and students, this study sets out to examine 1) students' and supervisors' needs and expectations in the CP preparation process and 2) what app functions and language support are expected and needed.

To obtain "a holistic view of student writing needs in a particular context" (Flowerdew, 2018, p. 5), the project team decided to use a dual-method approach in the collection of both subjective and objective data through the gauging of stakeholders' feedback and the analysis of student writing because "a combination of methods is preferred for a target- and present-situation analysis" (Flowerdew, 2018, p. 5).

Focus group interviews were conducted with 12 students and five supervisors of five disciplines (applied physics, computer science, electronic and information engineering, environmental science¹, and humanities), with open-ended questions on the three major issues: the challenges they faced or observed in CP writing, their comments on the app, and suggestions for its future development. The questions were deliberately phrased in this way to allow the respondents to express their views extensively. Responses from students and staff were then compared to see where agreements and differences lay. After that, consent was obtained to analyse nine CP reports from three disciplines² (electronic and information engineering, environmental science, and applied physics). The textual analysis of the nine CP reports focused on the four aspects that were identified as areas of concern by students or supervisors in the focus group interviews: 1) the introduction section, 2) the literature review and discussion sections, 3) lack of research mapping, and 4) referencing. A sentence-based approach was employed to examine "sentence-level features, inter-sentential relations, coherence breaks, and functional sentence perspective" (Connor, 1987, p. 680). This method allowed the project team to "target certain features of discourse" and make "data-driven" discovery (Leki, 1991, p. 132). Such a "textual orientation . . . work[s] to actively foster the construction in students of rhetorical schemata which hopefully correspond to those of English-speaking readers" (Leki, 1991, p. 135). Text analysis in the context of CP writing offered a means "to identify common problems" (Flowerdew, 2018, p. 5) for "purposive, tailor-made" materials (Flowerdew, 2018, p. 1).

1 The Department of Environmental Science was renamed the Department of Ocean Science in the 2018/2019 academic year. For consistency purposes, this article uses the former to refer to their staff and students.

2 Due to logistical constraints, the research team was not able to collect CP reports produced by students of computer science and humanities at the time of writing.

User Feedback: Findings from Focus Group Interviews with Students and Supervisors

As noted above, students' and supervisors' views were solicited in three major areas: challenges in CP writing, feedback on the app's functions, and suggestions for its future development. The interviews revealed interesting findings, including some commonalities and differences between students and teachers.

Challenges in CP Writing

Both students and supervisors agreed that the content of the final-year project posed the biggest problem for students. Student interviewees reported one common challenge, which was not knowing how to start their CP. They felt that they lacked ideas about their project requirements. Some students found it difficult to decide on a broad area for their final-year project and then narrow it down to a feasible research topic. Students also encountered various problems with finding appropriate literature. For example, a computer science student commented on the huge number of readings he had to do before he could select a focus for his study, whereas a humanities student struggled with locating enough information or sources to support his project. One engineering student expressed his concern about finding a suitable method that could be applied to his project.

These findings were in line with what supervisors found most challenging in CP supervision, which was guiding students on the content and organization of their reports. Students showed a lack of preparedness in undertaking the CP, which often requires intensive reading (Healey et al., 2013). As an engineering supervisor noted, students "may not [have] enough information and may follow some wrong path to reach their goals." A humanities supervisor observed that students were "not doing anything" at the initial research and consolidating stage of their projects. She pointed out that students should have done preliminary work over the summer, but when they finalized their project in September, they were "not ready to do so at all," and ended up changing their projects because they realized that "what they proposed earlier did not work at all." Most of the supervisors emphasized the importance of regular supervisor-supervisee communication. They believed there was a connection between students' (un)preparedness and the (in)frequency of their communication and interaction with their supervisors. The humanities supervisor believed that "if students meet their supervisors regularly, then any problems can be identified, but the motivation for students to initiate meetings is low."

Differences were found in students' and supervisors' perceptions of the most difficult section of the thesis for students. Students felt that the introduction chapter was the most difficult to write because of its important location in the whole report, being the first section that the audience reads. They also felt that the introduction chapter needed to include considerable content, e.g., it must present background information, explain the purpose of the study, and identify the study's contribution to society. None of the supervisors, however, mentioned the introduction section as posing the biggest difficulty for students. While the environmental science and engineering supervisors did find some problems in students' introduction sections, such as the lack of concrete objectives, they observed that their students often had more serious problems with other sections of the report. The engineering supervisor pointed out that the literature review was often very thin and did not contain sufficient relevant in-text citations. The environmental science supervisor reported that the discussion section was problematic, as her students could not include a critical analysis of the findings or do research mapping (i.e., a comparison of their findings with those presented in publications) to highlight the significance of their results. She also recounted how students could not provide concise summaries of "the key point of views in one or two sentences" in the conclusion section, and how some students failed to adhere to proper style guidelines in the references section. The engineering supervisor also mentioned the references section as a problematic area. The problem went beyond formatting conventions to the selection of sources. Students chose poor-quality references that were not appropriate or reported studies that were conducted in contexts that were considerably different from their own.

Another interesting difference between students and supervisors related to students' writing abilities. Students reported that their main worry was content, as they believed this was the aspect that their supervisors would pay most attention to. Organization and overall structure of the paper were also mentioned as areas of concern. Language did not rank as an area of high concern for students. Engineering students considered language as an area of medium-level concern because without good language, they could not express their ideas clearly; however, this was far less a worry than the technical aspects of their projects. While some humanities students showed awareness of the need for an appropriate style and tone in their CP, environmental science and computer science students did not mention language as an area of concern at all.

In contrast, all the supervisors commented on students' writing and other language issues. The humanities supervisor reported that some students sim-

ply connected loose and short excerpts from different sources and used them to write a literary analysis with minimal criticism. Similarly, the engineering supervisor noted that students tended to include all kinds of information without “filtering and processing” the content. He remarked that if students had shown him their work “maybe a week” before the submission deadline, he would have taken “a look” at the clarity and organization; however, students “seldom do it.” Common language problems that he often saw in students’ CP reports included misuse of tenses and reporting verbs, as well as expressing ideas using vocabulary that they did not completely understand. The applied physics supervisor echoed the engineering supervisor’s observations, while also noting that he considered CP supervision “a burden” and a time-consuming and challenging task because he did not consider himself “trained” to give feedback on English language or “fix” students’ writing problems.

Feedback on the Basic App Version

The second area covered in the interviews concerned the usefulness of the Capstone Ninja app, which received a positive response from students and supervisors alike. Students reported several aspects that they found especially useful, e.g., that the app helped them systematically learn about the requirements and expectations of the different sections of a CP report. They believed that the app was useful for self and flexible learning, and that it was convenient and easy to navigate. Although some respondents felt that some learning modules contained slightly too much information and could be made more appealing, the majority of the students reported that the bite-size learning modules served as handy and quick references for them during the writing process. This finding is in line with the project’s rationale of bite-size learning for better learner engagement and aligns with the call for just-in-time support, especially for year-long capstone projects (Omer, 2015). These student views were also in agreement with the comments from supervisors, who perceived the learning modules on the app to be providing helpful assistance to students in acquiring the skills of formatting and organizing a research report. As noted by the environmental science supervisor, the learning materials on the mobile app were “rich” and “enough for students to learn [the content] by themselves.”

The convenience in managing the project tasks was another feature that appealed to both students and supervisors. The majority of the supervisors found the self-management tools, such as the to-do list, valuable and useful for planning and checking CP progress. This was echoed by computer science students, who found it easy to set schedules and deadlines on the app.

Engineering students viewed the to-do list function on the app as a helpful reminder of their deadlines.

Suggested Features for the Future App Version

One of the features students and supervisors would like to see in future versions of the Capstone Ninja app is a chat function. Student respondents wanted to receive immediate and instant advice on their CP and use such a chat function to alert supervisors about uncooperative group members. Supervisors concurred that a chat function would be a valuable tool to schedule meetings and communicate about simple matters. The engineering supervisor considered the ability to communicate with students via the app a much-welcomed option as he would not want to give his mobile number to students.

Other suggestions made by students included developing content on oral presentations of theses, providing external links to online resources, giving them access to previous students' CP reports, and including pre- and post-learning module interactive questions to motivate them to "scroll" for learning. Supervisors generally favoured the inclusion of more interactive features such as videos and links to online resources. One supervisor also recommended developing an accompanying web version of the app for use in the office.

Textual Analysis of Students' CP Writing Problems

To further investigate the weaknesses in student writing expressed by the CP supervisors, nine CP reports were examined, with particular attention given to four aspects that were identified as areas of concern by students or supervisors in the interviews: 1) writing the introduction section, 2) writing the literature review and discussion sections, 3) doing research mapping, and 4) referencing.

Writing the Introduction Section

A close examination of the CP reports tended to confirm the concerns indicated by the CP supervisors that students' ways of stating research objectives can be "idiosyncratic." For example, the student writing in Excerpt 1 attempted to link the research gap to the project objectives but was not very successful. "The second objective" is confusing, as readers would probably ask how the recommendations relate to the project objectives.

Everyday Hong Kong and Shenzhen have a food waste enormous production which faces different aspect of challeng-

es. This project objective has two fold. The first objective is to compare the policies and technology of Hong Kong and Shenzhen in food waste problem, especially in recycling part. The second objective is to give some recommendations in both cities to achieve a more comprehensive approach to food waste treatment. (Excerpt 1: Environment Science CP Report A)

While an introduction usually contains a general background, literature review, and research objectives, novice student writers often struggle with the order of these features. Excerpt 2 shows unnecessary repetition of the objective statement before and after the background.

The goal of the task is to locate the vehicle in a static state with traffic lights and photodiodes through signal transmission. Currently, the Global Positioning System (GPS) is widely used in vehicle positioning through locating the vehicle via four satellites. However, GPS can be inaccurate and may fail to locate a vehicle precisely Therefore this task tries to improve vehicle locating accuracy with the visible lighting system and traffic lights, to tackle the inaccuracy problems of GPS. (Excerpt 2: Electronic & Information Engineering CP Report B)

Writing the Literature Review and Discussion Sections

One concern raised by supervisors related to students' literature review and discussion sections being too thin, without relevant scholarly substantiation. Indeed, textual analysis corroborates these observations as shown in Excerpt 3 and Excerpt 4 below, where the student claims were not supported by any findings.

Coatings with single element materials and binary materials were rather well investigated, but a little effort has been devoted to the development and research of materials based on multi-element structures such as composite ternary borides of aluminum and magnesium. (Excerpt 3: Applied Physics CP Report B)

Cloud-based, which application is an upcoming trend in the information world, because of shorter implementation times and without additional hardware or software requires Due to the potential benefits of cloud-based, more and more industries and companies would like to use cloud-based as

a tool to finish a different kind of missions (Excerpt 4: Electronic and Information Engineering CP Report A)

Research Mapping

The analysis of the student reports indicates that most students failed to show the relationship between the findings of the current report and published studies. Experienced writers tactfully show where and how their present work fits into the research map in their field. They also use research mapping to demonstrate the novelty or significance of their findings by showing that there is a lack of such findings in existing research reports. Excerpt 5 illustrates an unsatisfactory attempt at research mapping. While the Germany example was used to contrast the practice in Hong Kong and Shenzhen, no further details were given to substantiate the comparison with previous research findings.

To increase plastic recycling in Hong Kong, the key to success is how the policies are introduced and implemented With the all-rounded strategy, examples like fining those people who throw disqualified refuse into the bins and . . . would be capable of increasing recycling rate. This is what has been done in Germany but not in Hong Kong and Shenzhen. Therefore, a comprehensive strategy is crucial to ensure its efficiency. (Excerpt 5: Environmental Science CP Report C)

In the same way, Excerpt 6 has failed to elaborate on findings from previous research to present similarities in the results obtained.

Sediment with estimated calendric age of 595 years before present (BP) located at the top of the sediment profile also contradicts with the expectation. This suggests that mangrove in Xi Wan might be not naturally formed. Other results obtained from other research teams of this project (via personal communication) also evidenced the mangrove ecosystem in Xi Wan is a result of reclamation. (Excerpt 6: Environmental Science CP Report B)

Referencing

By making appropriate references to credible sources (i.e., including effective in-text citations), experienced writers engage critically with the text to show how their current research contributes to both the knowledge (Abasi et al., 2006) and their readers, in addition to how it relates to studies in the field

(Yates et al., 2005). Such explaining, however, is very challenging for ESL students, whose writing often exhibits features of patchwriting, i.e., the rearranging of words and phrases without truly paraphrasing the original sentences, and demonstrates difficulties in “using the existing literature to back up [their] points” (Pittam et al., 2009, p. 159). Although Excerpt 7 mentions a certain person, no scholarly reference was made to further illustrate the argument.

During last year, Mr. W. L. Cheuk of the Hong Kong Polytechnic University attempted to apply A* pathfinding algorithm and obstacle avoidance algorithm solve the problems of SLAM and Cooperative-SLAM . . . MR. W. L. Cheuk focus on enhancing the performance of Single-Robot SLAM, it inspires me very much. (Excerpt 7: Electronic & Information Engineering CP Report A)

Supervisors also commented that students included non-credible in-text citations, e.g., wiki articles, popular science blogs, and news articles. Excerpt 8 cites a newspaper article (深圳商報) written in Chinese, which the supervisor considered inappropriate:

In Shenzhen, there are two main policies which are . . . and 家庭生活垃圾分類投放指引 (深圳商報, 2017) to mitigate food waste problem. (Excerpt 8: Environmental Science CP Report A)

Another major problem of referencing was inappropriate format:

For the reference of an alert message, according to Marina & Kenneth, “Emergency vehicles at scene warning message size is 39 bytes.” (Excerpt 9: Electronic & Information Engineering CP Report B)

To summarize, a close examination of focus group interview data and textual analysis reveals that writing the introduction, literature review, and discussion sections of a research paper; doing research mapping; and referencing are challenging for students in their CP preparation process. Textual analysis suggests that novice CP report writers need help with situating themselves in the field by demonstrating the importance of their report findings and justifying their significance.

The Way Forward

The findings from the interviews and textual analysis have provided a clear direction for the app’s development, which can progress in three major ways.

First, it is clear that the app needs to include more learning content to help develop students' literacy skills in CP report writing. Supervisor feedback and textual analysis indicate the need to strengthen students' writing skills in the following areas: setting the scene well by making the introduction effective, developing a well-structured argument in the literature review and discussion sections, and doing research mapping and referencing effectively. To help students develop these skills, suitable excerpts from previous CP reports and credible publications should be used to illustrate the important concepts. Links to relevant external resources, such as credible websites that teach these skills, can also be incorporated into the app for students' extended learning.

A second area for future development pertains to the communication and self-management functions of the app. Both students and supervisors expressed their wish to use the app as a communication tool. In addition to mass notifications for one-way communication and announcements, a chat function is currently being developed for mutual communication on the app. Given the importance of motivating students to set CP-related goals, the team will explore the feasibility of developing more time-management tools, such as incorporating departmental CP timelines and setting individual milestones.

The third area in the app's development is testing and evaluating. Efforts will be made to expand student and supervisor use of the app, as well as to collect user feedback on the usefulness of the various app functions. One way of doing so is by including a "Comment" function on the app for users to relay their feedback. Another means of measuring the extent of student engagement with the app would be establishing a learning analytics mechanism on the back end that offers a systematic and quantitative approach to facilitate understanding of user mobile behavior.

In sum, Capstone Ninja is a one-of-a-kind mobile app bridging the gap in the provision of ubiquitous, multimodal CP language support for students across the disciplines. This study, which has offered fresh insight into supervisor concerns and supervisee needs, advances the development of English across the curriculum in the digital age.

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