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Title Conducting online design-based research: START e-business training as an educational intervention

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Abstract Design researchers undertake continual refinement, based on findings from analysed data, to make iterative changes to educational research that is particularly concerned with improving the effectiveness of the educational design. This includes generating a range of artefacts that bridge educational theories with practice, resulting in new knowledge that is useful for teaching and learning in complex settings. This research focuses on teaching business skills and computer skills through transformational, reflective, and experiential learning interactions and practices. It is argued that constructivism theory provides a suitable approach for educating adult Arabic-speaking migrants to build on their skills, so they can make sense of their experiences, and continue their professional education.

While we teach the Arabic-speaking migrants both business and computer skills directly, we can indirectly enhance English skills, if we focus on different aspects of English as suggested by English for specific purpose theory. This intervention constitutes a new approach to educational design. In developing the intervention, we applied the ADDIE model for instructional design. The learning management system that hosts the educational design is Chamilo. The research design uses quantitative and qualitative data collected through Chamilo including an online survey, data logs, and practical tests and quizzes. As well as data collection methods embedded in Chamilo, participant observations during Skype support sessions provide another data source for evaluating trainees' learning and design effectiveness. This paper coalesces some considerations and limitations of online design-based research, while it also draws some reflections and action plans to overcome potential challenges in data collection as part of DBR iterative refining processes.

Conducting online design-based research: START e-business training as an educational intervention

Amelie Hanna, Lindsey Conner, Trudy-Ann Sweeney

1.0 Introduction

Arabic-speaking migrants to Australia are experiencing an extremely high unemployment rate (~ 20.5%), which is 3-times higher than the average unemployment rate in Australia. It has been suggested that this high unemployment rate amongst this group is due to their lack of English skills and computer skills (Hanna & Conner, 2020), as well as the lack of equal opportunities due to their Middle-Eastern names (Pinkerton, 2013). Furthermore, Arabic-speaking migrants might suffer from a lack of professional competencies such as critical thinking, problem-solving, networking, decision-making, and teamwork skills (Castellazzi, 2016; Dengler, 2019). Therefore, to help these Arabic-speaking migrants increase their employment chances, we need to enhance their English and computer skills simultaneously. One way to address the lack of equal opportunity in employment for Arabic-speaking migrants is by educating these migrants to establish their e-businesses by using their professional skills or their interests (hobbies). This is especially important at this time since the unemployment rate is increasing due to Covid-19. e-Business is argued to be a Covid-safe way to be employed. However, to enable migrants to establish their businesses, they need training to enhance their language and computer skills (Kury & Redo, 2018). However, the question about whether re-employment or self-employment is more effective has been asked, especially when the answer to that question helps in selecting what sort of training can be provided to assist these unemployed migrants.

Furthermore, self-employment assistance training programs can be more effective in promoting innovation in the workforce (Wandner, 2018). Business training is needed to assist the unemployed to set up their businesses. Although the Australian Government provides an incentive scheme to help set up businesses (NEIS, 2020) and provides services that help small businesses make the most of digital tools to assist them in running their businesses, these services do not provide the integrated training that is specifically designed for supporting Arabic-speaking migrants to uplift their skills first. Having a cohort who have the same first language and share similar needs and are supported by a bi-lingual skilled tutor can better integrate English as part of business and computer training. Before producing an educational intervention that will be used to upskill the Arabic-speaking migrants and help them establish their businesses, we needed to know and select relevant theories, that can inform the current study.

In reviewing different relevant theories, we focused not only on skills development theories but also on how these theories can be linked together towards building the theoretical framework that informs the study and its intervention.

1.1 Research background

Developing the three different skills (computer, business, and English) in one training intervention was a driving force for the design, especially in relation to educational theory and research that informs the most effective design. We must admit that no single learning theory has emerged to be appropriate for instruction and online education. Indeed, some theories are considered to be appropriate for the online environment – this is because the existence or non-existence of core components of online education tools and their affordances, such as the discussion boards, blogs, wikis, and videoconferencing define which model, a specific combination of tools and features, can be best in achieving different learning objectives and goals (Picciano, 2017). This paper does not aim to present the development of interaction itself, but rather to discuss what we can do to make the design work for the Arabic-speaking migrants. To progress in this study, we need to ask certain research questions; and by answering these questions, we might have a clearer research path.

1.2 The study aims and research questions

This study aims to assess an intervention that helps improve business skills, computer skills, and English skills to optimise the training for better learning outcomes in each cohort as the intervention progresses. The research questions are:

1) What is/are the educational theory/theories that inform this study?

2) How can the intervention be designed and implemented to enhance business skills, computer skills, and English skills simultaneously?

3) What tools and processes will assess the learning outcomes of Arabic-speaking trainees? How can formative and summative assessment outcomes be used as data for the research process?

4) How do components of the learning process contribute to evaluating the effectiveness of the training program and inform iterative changes in the educational design?

To answer how we can make our design work and why, we need to consider a research approach that provides us with the opportunity to conduct an intervention, in less controlled settings than typical experimental research, but at the same time describes the intervention in "explicit terms so that it can be implemented" (O'Donnell, 2005, p. 231).

In other words, the design research, as presented here, focuses on the procedures for the design of educational interventions (Brown, 1992). This paper presents answers to these research questions as outlined in the following sections and subsections as well as draws some reflections and action plans to overcome potential challenges in conducting the training intervention and the research project.

2.0 Theoretical foundation

Constructivism theory asserts that learning encompasses a process of constructing meaning when enabling people to make sense of their experience and reality; and that the knowledge is of interest to them, where learners are encouraged to develop new knowledge that continues to build on their previous experience. This new knowledge is gained through engaging, incorporating new ideas and skills, developing critical thinking, and interacting with others and content to make interpretations and rational reflections. Given this study is situated in adult continuing professional education, constructivism provides appropriate insights because "much of our adult learning theory is constructivist in nature" (Sharan et al., 2007, p. 293). More specifically, constructivism depends on self-direction of inquiry, individual construction of meanings, and independence in performing different tasks or activities (Candy, 1989). The constructivist approach is well-founded in instructional design, especially when there are opportunities to integrate computer technology into problem-solving (Conner, 2021; Picciano, 2017). Each learner produces their knowledge and forms meaning based on their prior experiences (McKenney & Reeves, 2012). The current study is based on constructivism learning theory because learning is achieved through different activities and tasks that are designed to meet their real needs – as discussed in detail below.

In constructing the knowledge and experiences, learners usually participate in learning activities and tasks that involve peer discussions, questions to elicit their existing information, flow diagrams, online forums, and the use of lists and other learning tools (Stewart, 2013). Identifying authentic learning goals (Windschitl, 2002) as well as authentic learning activities which are built around authentic problems and projects from the real world (Wilson, 2017) are core pillars for a constructivist approach. This experimental learning draws a useful connection between constructivist education and entrepreneurship education.

It was argued that there are similarities between entrepreneurial education and constructivist education, especially with experiential learning, problem/project-based learning, and adult learning; and this is because the learning-by-doing allows learners to connect their knowledge to practice, through curiosity, creativity, personal responsibility, and initiative can lead to meaningful outcomes (Lackéus, 2015). In a survey study on unemployed migrants who received entrepreneurship training to develop their abilities to prepare business plans, choose a business location, create network marketing, manage

resources and create income statements, it was found that these migrants were satisfied with the training, as the guidance and mentoring helped them in increasing their motivation to create their businesses (Busro, 2018). Such results can be argued to be relevant to the current study, especially when the intervention is designed to meet Arabic-speaking migrants' real needs.

Features of authentic learning involve authentic context, authentic activities, collaboration, reflection, expert performance, coaching and scaffolding, integrated authentic assessment, articulation, and professional learning (Bower, 2017). There are several characteristics of authentic activities; and these characteristics include having real-world relevance, comprising complex tasks, with opportunities to collaborate and reflect, and more importantly, to develop a polished product or solution that is valuable to learners (Mattar, 2018). It was found that the constructivist approach was extremely valuable in business education as it helped learners to succeed in complex and dynamic contexts (Wang & Peyvandi, 2018). Similarly, a constructivist multimedia learning environment can enhance the development of computer programming skills (Samat et al., 2017). In the following subsections, we discuss how both constructivism and English for specific purpose (ESP) theories can be suitable for the current study, especially when knowing that their applications are flexible enough for educating non-native English-speaking adults.

2.1 Constructivism and English for specific purposes

English for specific purposes (ESP) is in alignment with a constructivist approach because it ensures the parallel acquisition of specific knowledge together with the acquisition of the target language (Tarnopolsky, 2012). ESP courses help students to develop the communication skills they need for targeted future situations by focusing on the specific linguistic knowledge and communication to accomplish specific purposes – it is speciality-oriented (Živković, 2014). Therefore, teaching/learning ESP is not only learner-centred but also knowledge-centred. Živković (2014, pp. 24-26) argued that modern ESP constructivist learning environments are technology-based in which learners are engaged in meaningful interactions using technologies, and they actively participate to construct knowledge, develop autonomy, interact and complete a task successfully because such practical settings help learners to be ready for the challenges they might face in future work settings. Moreover, such experiential learning results in a viable constructivist approach which makes ESP teaching and learning practice more credible and efficient, as it not only helps learners to acquire professional knowledge and skills, but also implicitly and subconsciously develops their English professional communication skills (Tarnopolsky, 2018). ESP has previously been applied to teach a range of topics in English and proved to be instrumental in enhancing knowledge and skills in specific subject matter while enhancing English skills (Johns, 2012; Paltridge & Starfield, 2013). There are a number of applications of these two

theories that are argued to have some relevance for the current study, especially when learning objectives are related to professional education and real-life situations.

2.2 Applications of constructivist ESP

ESP has been applied to teach business (Zhang, 2018) as well as information and communication technology (ICT) education (Mamakou & Grigoriadou, 2010). Providing transcriptions of audio podcasts can increase English competencies (Kavaliauskienė & Anusienė, 2009). Furthermore, when translanguaging is used during training, its interactive processes to negotiate meanings, e.g. in the first language and English, help to maximize understanding and develop skills in the weaker language (Mazzaferro, 2018). As well, identifying the core vocabulary for a learning context for ESP learners (and in this study, e-business) is important. As Coxhead (2013) suggested, making a word list of specialized vocabulary is a common approach – and can differ according to the context and subject. Regardless, second language learners need pragmatic knowledge that helps them to accomplish certain tasks effectively and appropriately (Paltridge & Starfield, 2013). Translanguaging has had positive effects on learning vocabularies (Galante, 2020). To apply ESP pedagogy (Tarnopolsky, 2012), the ESP needs to build new knowledge and skills based on authentic professional content, achieve professional goals, and reflect on real-world situations. More importantly, learners must be active in learning activities that help solve professional or real-world problems.

In the educational design of this intervention, professional problems involve differentiated learning activities, where each learner can reflect on their own experience and intended business and apply these to their new knowledge in their specific context as they master business and computer skills. As noted in a previous study, designed for training university staff (who had different backgrounds and interests) to enhance their business skills or professional competencies, the course also helped them in enhancing their English language proficiency (Aylazyana & Obdalovab, 2014). In summary, constructivist ESP appears to be suitable as a theory to be applied when educating Arabic-speaking migrants about how to establish their online businesses or at least to enhance their employability by lifting their English, ICT/computer, and business skills. After we have answered the first question, we need to answer how the intervention can be designed and implemented to enhance these skills simultaneously – which is explained in the following section.

3.0 Developing the educational intervention

According to McKenney and Reeves (2012), in using a constructivist approach, each learner develops their new knowledge based on their previous knowledge and experiences. Arabic-speaking migrants, in the proposed training program, come from different countries and differ-

ent educational backgrounds and have different interests and professional skills concerning the e-business they inspire to set up. While the content of the training has a common basis, the learning activities are personalised for the trainees, as they depend on their prior knowledge, skills, and business interest, where each learner reflects on their needs and intentions for developing their e-business. However, when designing and developing an educational intervention, we also need a theory that can tie the design specifications and the practice of training with the research.
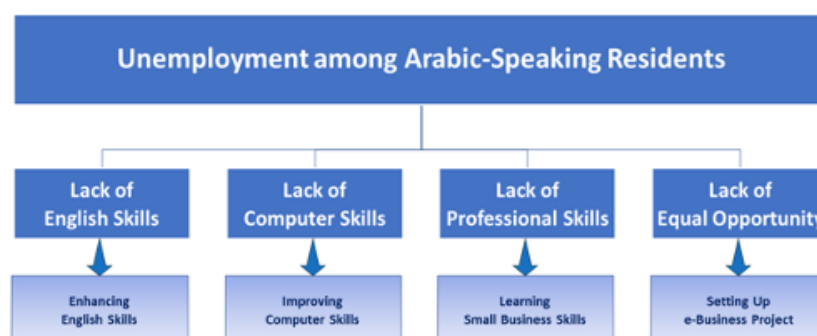

Figure 1: Educational Intervention: START Training Program

Design-Based Research (DBR) tries to merge educational research and practice together – as it involves the creative design of development of educational resources as well as a systematic study and evaluation of educational resources and learning outcomes. It does not only embrace the traditional approach to the ADDIE model for instruction (Analysis, Design, Development, Implementation, Evaluation), but also moves beyond it to answer how and why a particular design works (Cernusca & Ionas, 2014). While the DBR process encourages design innovations, it also helps in generating the data for explaining the effectiveness or ineffectiveness of the intervention and it provides data-driven evidence for redesign and enhancement through iterative processes, where activities in each iteration are informed by the outcomes of the activities in the previous iteration. The training program, the intervention, blends computer, e-business, and English skills training and is called START – Smart Training for Arabic Residents on Technology (Figure 1). To design and develop START training, we adopted the ADDIE Model for instructional design, which enables the creation of high-quality teaching and learning materials, and involves specific points where data contributes to the design-based research process.

The ADDIE model encompasses 5 phases: Analysing learners' needs; Designing an effective learner's environment; Developing learning materials; Implementing instructional strategies; and Evaluating the results of the development (Branch & Kopcha, 2014; Rothwell et al., 2015). These steps are also similar to the pillars of adopting ESP (Anthony, 2018). The ADDIE model has been applied to develop an educational design in learning management systems such as Chamilo (Astriawati & Djukri, 2019). START training has been designed and developed by following the steps of the ADDIE model:

3.1 Analysing learners' needs

As discussed in the introduction section, Arabic-speaking migrants to Australia face barriers to employment due to their lack of English skills, ICT skills, and professional skills. After we identified the probable causes for unemployment, we determined the instructional goals to bridge these skill gaps. The instructional goals are to 1) Improve a range of computer skills; 2) Enhance English language skills, 3) Learn about small business skills, and 4) Set up e-business projects, which combine these previous skills.

3.2 Designing an effective learner's environment

The intervention was designed to include 10 lessons and it culminates in an e-business project. In most of these lessons, trainees develop computer skills as well as business skills – as outlined in Table 1. Mastering different English skills (listening, speaking, writing, reading, and mastering vocabulary) is an indirect learning objective, which is achieved through glossaries, lesson materials, and learning activities. In other words, and drawing from the broad learning objectives of the intervention, as presented in Figure 1, Table 1 outlines the direct learning goals of the intervention which combines both computer/ICT skills and business skills, while improving different English skills that are implicit learning goals of the intervention. The development of the content of these modules is presented in detail in the next step.

Module	Business Skill	Computer Skill
01	Assessment of Business Idea	Experiencing Internet Navigation
02	Understanding Business Structure & Licenses	Searching Professional Online Databases
03	Building Business Plan	Learning Microsoft Word
04	Record Keeping for Income & Expenses	Learning Microsoft Excel
05	Building Business Presence	Learning Microsoft PowerPoint
06	Maintaining Customers Database	Learning Microsoft Access
07	Basics of Social Media Presence and Marketing	Learning Facebook Group & Page Creation
08	Experiencing Email Marketing	Learning Microsoft Outlook
09	Understanding Online Professional Image	Practising Website Development using WebsiteX5
10	Selling Online	Building Shopping Cart using WebsiteX5
Project	Practising the above Business Skills	Practising the above Computer Skills
	and Practising Setting up e-Business Projects	

Table 1: START Training Lesson Objectives

3.3 Developing lesson content

The lesson content includes video materials for each lesson, which cover the learning objectives for developing computer and business skills (Table 1). Furthermore, listening to these videos can indirectly enhance English listening skills (Goh, 2013). As indicated by previous studies to increase the comprehension of learning English (Kavaliauskienė & Anusienė, 2009), transcription of audios was also provided. Each lesson is accompanied by links to external learning resources for additional reading. These resources and reading materials, including the syllabus, can also help in developing English reading skills (Hirvela, 2013). Each lesson has different learning activities including participating in online forum discussions and producing documents and communication letters or emails to potential customers and this will help in developing their writing skills (Hyland, 2013). Other learning activities include synchronous group discussions. Making recorded video poster presentations helps in improving English speaking and listening skills (Feak, 2013). Each lesson has a specialized vocabulary (Coxhead, 2013), that covers both business and computer terminologies, accompanied by an English-Arabic translation. The translanguaging that will occur in the synchronous online discussion groups helps to negotiate meaning, which helps in improving English skills. Also, translanguaging will have a positive effect on learning vocabulary (Galante, 2020). These lessons are all delivered online including all teaching and learning activities and assessments. Such active processes to develop the subject matter knowledge and skills proved to enhance English skills, especially when learners are required to use the technology to edit, publish and share information (Esteban & Martínez, 2014). After developing lessons' content, the START modules were implemented.

3.4 Implementing the instructional design

Firstly, a website for the START Training was developed which is hosted on a Linux server. This website is available in two languages: English and Arabic. On this website, a video provides an outline of the 10 lessons of START training (Hanna, 2020). There is also an associated Facebook page and LinkedIn page for the START training announcements. There is an associated Facebook group for discussion, recruitment of trainees, and feedback. Each lesson was developed using Articulate Storyline 360 (Articulate, 2020). The scripts of these modules were converted to audio files using Google Text-to-Speech API (Google, 2020). English transcripts and Arabic translations for these audio/video materials are provided inside the notes section in the story files. There is a glossary in the Storyline, which was used innovatively, to provide Arabic-English specialized vocabulary for each lesson. Each lesson is accompanied by subtitles for the played videos. These Storyline files were uploaded and hosted on a Learning Management System (LMS) called Chamilo (Chamilo, 2020) after we configured its settings. Chamilo was used previously to develop scientific literacy skills (Astriawati & Djukri, 2019). Chamilo LMS is featured with wikis

and forums, and these tools are useful for collaborative learning activities. As well, the glossary provides Arabic-English descriptions of key definitions. Chamilo is ranked the highest among other LMS for course development features, including course authoring, custom user interface, and its exam engine. In addition to the administrative features such as tracking and reporting, content management, and notifications, there are collaboration features including chat, discussion board, blogs, announcements, and wikis (Elabnody, 2016). Beyond the technical features of the implementation, the 10 modules, as outlined in Table 1, were developed using Articulate Storyline 360, and then they were uploaded to Chamilo LMS, as SCORM zipped files, in its learning path functionality. This learning path functionality has also provided the opportunity to implement the surveys and tests, as part of the data collection methods used in this study. Before conducting the training, the implemented training was tested and evaluated first to ensure its accessibility and functionality.

3.5 Evaluating results of the development

Evaluation of the developed design is in two stages: before and after participation (Rothwell et al., 2015). The main author, the developer of the modules, has tested the technical aspects for each stage to make sure that links are working, audio/video materials are loading properly, and are of good quality, including the notes being easy to understand. Accessibility features were considered and checked.

The co-authors were involved in the pre-use evaluation and they acknowledged its quality and logical progression and said on 16 October 2020:

> "The introduction and explanation of the modules are very good! It is straightforward and provides an outline of the modules. I really like it – even an Australian narrator!!! It's great having the Arabic text at the bottom."

Also, the START training outline video (Hanna, 2020) was presented to academic colleagues (Hanna, 2020), and the feedback received was positive. It was also presented at an international conference and the feedback was positive too (Hanna, 2021). Also, a peer-reviewer has provided written feedback on 16 September 2021 and commented on the presentation of the whole project:

> "The START (Smart Training for Arabic Residents on Technology) initiative was explained well. Research methods utilised for this initiative were also explained. The presentation style is informative and clear... The pre-recorded section worked well, specifically designed to capture the audience with appropriate graphics, and to upskill knowledge on barriers and enablers to business development for Arabic-speaking residents in Australia. ... I think you have done an amazing job with this. English as a second language adds an additional layer of complexity, and creating lectures that meet needs is always good to see."

In her peer-evaluation of one of the START Training modules: Assessing Business Idea, she commented:

> "The layout of this teaching module is unambiguous and well described. The pace of the teaching module is good. The design of the project is clearly defined into topics... Students [Trainees] are asked to brainstorm across a number of questions posed in the online presentation. Students [Trainees] are asked to think about barriers in business and how they may overcome them. How do they provide a product that is effective, efficient, and compares well against competitors? SWOT Analysis is used as a model in this teaching activity. This works well. Communication for Arabic-speaking students is assisted through captions in Arabic (beautiful Arabic writing). An online survey is used to collect feedback and a quiz is used to gather information, Online Skype is used for discussion and questions... The teaching activity is easy to understand. Quality graphics were used in the online teaching activity. The time and effort taken to make this online teaching activity informative are evident… Amelie teaches a highly specialised topic that is specific for Arabic-speaking students and delivered in the English language. There are challenges that come from this. The overall presentation, tone, and pace of delivery are essential for the student experience. Amelie provides a media-rich experience that enhances the exchange of information in the absence of face-to-face discussion. There are ample opportunities for questions, and feedback provided. There is a clear direction of the following module outline given."

In continuing to provide her feedback, she commented:

> "Look towards ways that enhance the presentation further and reduce the length of blocks of the automated voice. Whilst the graphics, both in the presentation and the slides are great, possibly consider increasing variety within them."

The feedback evaluation about reducing the length of blocks of the automated voice has been considered in the refinement. However, what is more important in guiding the refinements is the feedback and analysis of data we receive from the trainees. Each intake provides us with the after-use evaluation, which will be analysed for refining the design for the following cohorts of trainees. It is too early to discuss the refinement processes of START training, as it will incorporate results of data analysis collected from the trainees as well. Furthermore, discussing these feedbacks and refinements is beyond the scope of the current paper. As it was argued above, in order to know how we can make the design work and why, it is crucial to describe the intervention explicitly, so it can be implemented – that is why one of the research questions that was answered in this paper is explaining the procedures of designing and developing the educational intervention. Although we have explained the design processes in explicit terms, we also need to describe clearly how data will be collected from the trainees to in-

form the refinement iterations. Discussing research and data collection methods provides an answer to the third research question – as described in the following section.

4.0 Research methodology

In order to determine the techniques and procedures that are to be used in data collection, we had to select an appropriate research methodology first that is consistent with the theoretical foundation and, at the same time, can work alongside the process of instructional design. It is argued that design-based research (DBR) is adequate as a research methodology for the current study. DBR encompasses interventions that are specifically designed to enhance educational artefacts as they progress (Brown, 1992). Proponents indicate that design-based research was originally derived from instructional design (McKenney & Reeves, 2012). DBR involves cycles of evaluation and feedback loops. DBR is quasi-experimental in nature, as it aims to test and refine educational designs by generating evidence-based claims about learning and implementing iterative refinements during the research/design process (Collins et al., 2004; O'Toole & Beckett, 2013). These experiments are concerned with the design of various aspects of the learning environment, including materials, tools, tasks, patterns of communication, and interactions (Reimann, 2011). The following subsections present the justifications for using different research methods that will be used in the current study and how they were incorporated into the design.

4.1 Justification of selected mixed-research methods

Researchers and scholars are using quantitative and qualitative research approaches together in their research to address complex research problems. In these mixed research methods studies, a combination of different aspects of quantitative and qualitative research, including research questions, data sources, techniques of analysis, and interpretations, are associated with these two approaches to developing comprehensive understanding (Creswell & Plano Clark, 2011). While mixed methods research is argued to have its potential for addressing complex research questions, it also presents some challenges because researchers need to "creatively and logically design and implement the combination of methods in ways that allow them to generate meaningful and defensible conclusions" (Plano Clark, 2019, p. 107). The current study encompasses a complex research problem that is reflected in the research questions because they are not only related to the design of the intervention, but also involve socio-cultural and individual determinants that may impact the efficacy of the intervention, which needs to be refined in each stage. As Creswell (2015) discussed when conducting an intervention, researchers are not only concerned with quantitative measures of the outcome, but they are also interested in the stories behind these numbers, so they gain an in-depth understanding of how the intervention has worked and why.

Such an understanding helps refine the intervention, including the design, the delivery of training, and the learning outcomes.

Design researchers need to review the design iteratively to optimize the solution or intervention as much as possible by using both qualitative and quantitative data (Collins et al., 2004). In other words, DBR is characterized by its mixed-methods research approach (Baumgartner et al., 2003). For example, Parmaxi and Zaphiris (2020) have employed mixed methods, including instructors' field notes, students' and instructors' reflections, questionnaires, focus groups, and semi-structured interviews, in their intervention to teach Greek. This study applied a pragmatic mixed-methods approach that was considered during the implementation of the intervention (Outhwaite et al., 2020), which is common in research designs that employ a quasi-experimental approach (Rapanta & Felton, 2019). This is because the core of DBR is to test and refine educational designs by generating evidence-based claims about learning.

Refinements occur during and as an integral part of the research process; and in that sense, it coincides with the experimental processes that are used in hard sciences. These experimental refinements occur in the design of various aspects of the learning environment, including materials, tools, tasks, patterns of communication, and interactions (Reimann, 2011). Reflecting on the current study, trainees will provide their feedback about each aspect of the intervention, including the design itself, the delivery of training, the provision of support, and the learning outcomes – as discussed below.

Since the development of knowledge and skills (business, ICT, and English) is the core aim of this training, then we need to assess multiple learning outcomes. Commonly, the methods used to measure learning outcomes include self-reported surveys, grades, and test-based measurement (Caspersen et al., 2017). While grades provide an overarching measure of learning outcomes, tests have the capacity to measure outcomes for different competencies, dimensions, or knowledge domains (Humburg & van der Velden, 2015). In this research, tests will be used at the beginning and end of each module to enable an assessment of progress for the START trainees in terms of knowledge and skills. Surveys are widely used to collect large amounts of data (Saris & Gallhofer, 2014). In this research, there are two kinds of surveys: at the end of each module and at the end of the START training. Answers to questions in module surveys will influence refinements of the module for future cohorts of participants. As well, the analysis of the end-of-training survey will be used to draw a bigger picture about trainees' progress and help in preparing for the follow-up online in-depth interviews. In-depth interviews (Boyce & Neale, 2006) with the START trainees contribute information about their experiences related to the program including its activities, processes, and outcomes, and about any changes they may recommend for future programs.

The interactions during learning activities, whether related to the content, the instructor, or among the trainees, provide a good source of

information (Lu & Law, 2012). Logs of actions and interactions are recorded electronically. When log-data is used in educational research, it gives an in-depth understanding of the path learners use, and when it is accompanied by an analysis of the frequency of clicks, this can provide better information about what participants focused on and the frequency of their level of inquiry (Michaloudis et al., 2018). Learning Analytics (LA) provides powerful information about learners' performance and their learning progress, and these include login frequency, time spent in the system, number of downloads, number of performed exercises, interaction with peers, and number of forum posts (Mwalumbwe & Mtebe, 2017). Since the training itself needs to be refined, the interactions and reactions of trainees are included in the evaluation as well. Observation provides a systematic approach to 'watching' inquiry of events, occurrences, processes, reactions, and relationships (Smart et al., 2013). The first author acts as a participant-observer and will take semi-structured notes during the video conference discussion sessions. These notes will be recorded according to an observation guide.

As discussed above, we selected different data collection methods that can provide insights into the design of the artefact and the delivery of the training as well as the measured learning outcomes. These data collection methods need to be incorporated logically within the intervention, so data can be collected safely by taking into account the ethical considerations and privacy and confidentiality of the participants (Hanna et al., 2020).

4.2   Implementation of research methods

Before collecting data from the research participants, the trainees who decided to participate in this study, some ethical considerations are taken into account. These considerations include the provision of an information sheet, ensuring that participation in the training will not be impacted by their voluntary participation in the study, as well as maintaining their identities private. More specifically, the information sheet about the research project is made available on the website, and participants will not be able to proceed to sign the consent without reading this information sheet. To maintain the privacy of participants or learners, Arabic-speaking residents provide nicknames (pseudonyms) for themselves. The database of the collected online consent forms is separate from the learning management system that contains the learning activities. When an Arabic-speaker resident indicates their interest to participate in the START training, they receive an email to arrange for a phone call with the main author. This conversation seeks information about their skills, interests, hobbies, and ideas, and they are evaluated for whether these ideas have the potential for a successful online business. These phone calls are not audio-recorded, but notes will be collected during the call according to the pre-constructed guide.
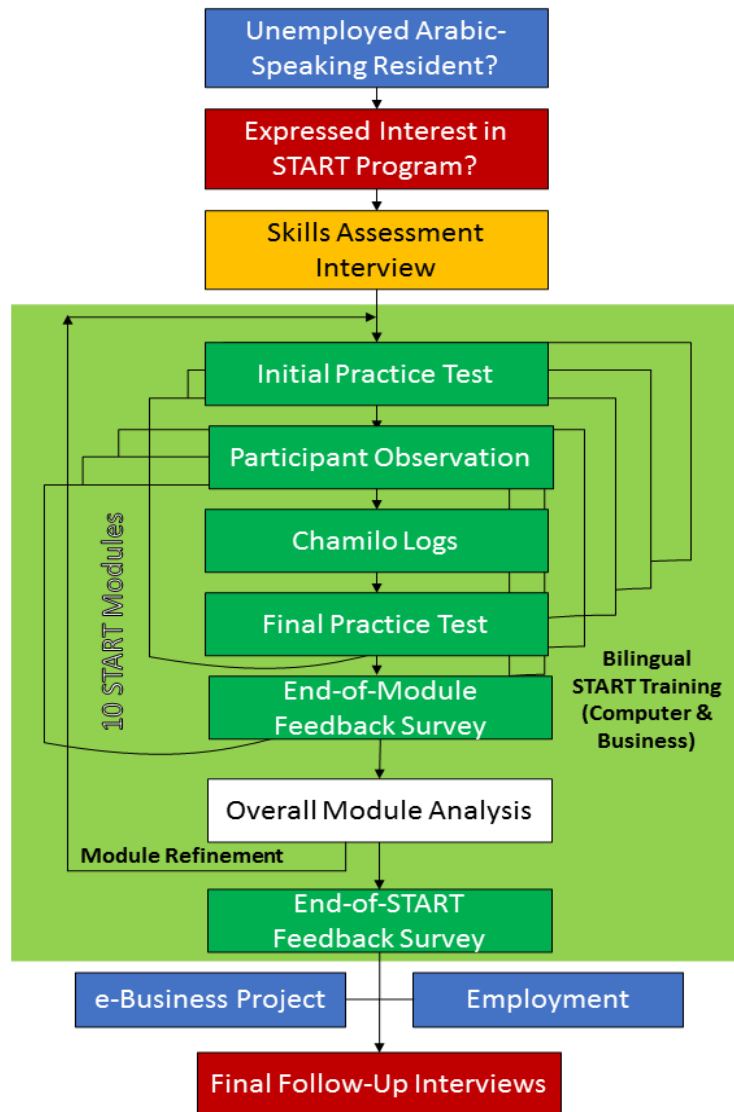
Figure 2: Arabic-Speaking Trainees' Journey in START Training and Research Methods

Chamilo Learning Management System is used to host the learning modules and most of the research methods. Arabic-speaking trainees will go through a certain learning path as identified in Chamilo LSM, from one module to another. We will be using different built-in functions in Chamilo LSM for the data collection (Figure 3), and these include tests to assess the learning outcomes of trainees. Furthermore, the survey function will be used to collect data from trainees about each module and at the end of the START training. Also, the reporting feature in Chamilo LMS provides learning analytics. At the end of each module, there is an online discussion session using Skype. The first author will be collecting notes about these discussions using an observation guide. Analysis of data collected from these different methods during each iteration of the intervention (Figure 2) will help in refining the intervention – as discussed in detail in the next section.
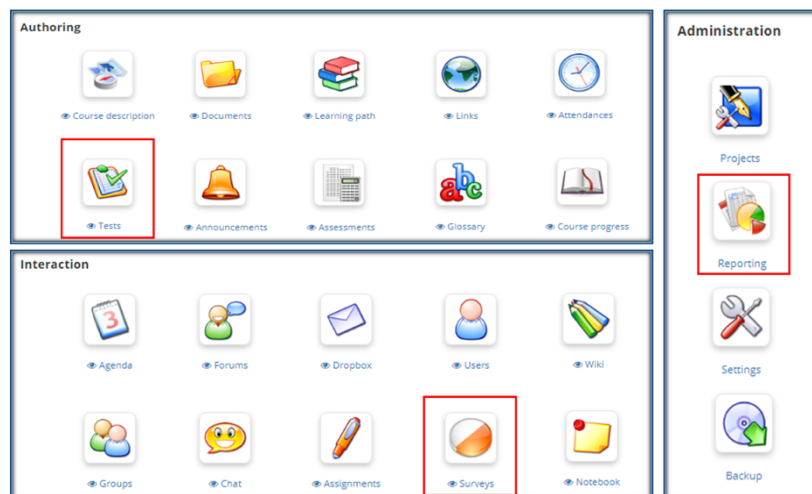
Figure 3: Useful Chamilo LSM Functions for Data Collection

5.0 Challenges, limitations, and actions plan

This research is an interventional study, which involves a refinement after each iteration. There are some challenges associated with interventional studies in general, and in this study, in specific, as part of the continuous cycle of refining the intervention after each iteration. This section discusses the cycle of the intervention and the acknowledged challenges and limitations. Furthermore, as part of this study, there is an action plan that is proposed to address potential challenges in conducting this interventional study.

5.1 The cycle of the intervention and refinements

The main aim of the current project is to refine the intervention, so it becomes effective in achieving its objectives and outcomes. In other words, the results we can obtain from the analyses of collected data (both quantitative and qualitative) will inform and direct the refinements in the design itself (modules, resources, external resources, quizzes, audios/videos, animations, images, glossaries, syllabus, etc.), the training (activities and interactions), and learning outcomes (knowledge, skills, and project). Knowing areas of strengths and aspects of weaknesses will help in refining the intervention, so it becomes better in each following iteration.

Arabic-speaking migrants participating in this study, as demonstrated in Figure 2, are interviewed first to ensure that they have not only the basic English and ICT skills to participate in the training, but also that their business ideas (from their skills and hobbies) have the potential for the development of an online business. Interested participants in START training are grouped into different intakes. Trainees in each intake are required to complete the 10 modules of the START training as well as develop their project – as outlined in Table 1. During the START training, trainees are required to participate in practical tests before and after each module as well as different learning activities during the

modules. After each module, trainees have the opportunity to participate in support sessions; and notes are taken during these sessions. There is an End-of-Module survey that trainees are required to answer. All data collected through each intake will be analysed and evaluated.

The evaluation will guide the refinement of the intervention before the following intake. Documenting these iterative refinements will help not only answer the fourth research question, but also provide future direction for the application of such intervention to different disadvantaged cultural groups. At the end of this study, and based on findings from each stage, there will be interviews with some trainees to gain an in-depth understanding of how the START intervention has helped them in setting up their businesses and whether there are any key challenges or weaknesses that can be considered in future programs.

5.2   Limitations and actions plan

This paper presents the START intervention in its different stages, from selecting the relevant theories, designing and developing the training artefact, selecting and incorporating data collection methods in Chamilo, to thinking of ways to refine the intervention. Moreover, educational interventions are becoming more complex as a result of overwhelming efforts to analyse the collected quantitative and qualitative data (Onwuegbuzie & Hitchcock, 2017). Moreover, while there are some critical questions about the methodological levels of the collaboration between practitioners and researchers working together in DBR (Emmler et al., 2020), such a critique is also unavoidable in the current study, considering it as a PhD study where the main author is the designer of the intervention, the trainer and the researcher – an acknowledged limitation in the current study. Furthermore, since the participation in this study is voluntary and the intervention spans a period of time, it is expected that there will be a low response rate and potentially a high turnover. To overcome the potential low response rate, the main author will also use content analysis for emails, START website blog, LMS chat, and comments to the Facebook group. While the online survey seems to work better than online interviews in a previous study (Gerholz et al., 2020), such a problem can be avoided in this study by not restricting interviews to be conducted via a specific medium.

While translanguaging can be minimal during the Skype discussions, which can develop listening and speaking skills, the live text chat through Chamilo LMS can also help to negotiate meanings and enhance both reading and writing skills. To avoid the burden of transcription (Stewart, Shamdasani, & Rook, 2007), the main author decided to take summary notes for the participant observations; however, audio-recordings of these sessions are collected to refine these notes. Although it will be really difficult to "recreate" the exact learning environment and learning activities in future programs (Zheng, 2016), the optimization and refinement cycles, in the current DBR study, will sup-

port the development of more effective teaching and learning processes as well as learners' feedback to make adjustments into the START Training for each intake. In other words, the evidence-based refinement process itself is argued to be an expected outcome of the current study.

Most research in the field of translanguaging heavily depends on qualitative research methods due to the nature of the field and the researchers in this field (see for example Turner, 2020). However, when research in this field depends on the quasi-experimental design, as in design-based research, mixed methods are used. For example, tests are used to provide quantitative data while observations are used to provide qualitative data (Galante, 2020). In Galante's (2020) study, it was argued that data analysed from tests did not provide enough understanding of what learners found interesting and promoted their engagement in the activities. Furthermore, such a study was conducted in a classroom setting and it focused on language learning only.

6.0   Conclusion and expected outcomes

Although authors have attempted to answer the research questions, the application of the intervention will bring more questions that may require further research. Furthermore, while the results of the data analyses may provide a clearer picture of the refinements that are needed in the intervention, further challenges will appear in selecting what changes are applicable and worth implementing or not. Admitting the unclarity and complexities in conducting this online design-based research and any associated limitations, some potential outcomes are expected to benefit the trainees as well as some other contributions to knowledge and research in this area.

While DBR interventional researchers select different research methods according to their needs, and they apply their findings to their unknown reality, even when the research was conducted in formal education settings (Anderson & Shattuck, 2012), this study goes beyond formal education to adult education related to professional development guided by participants' interests to establish online businesses. Although interventional studies aim to assess the delivery and the reach of a specific program through its different levels (the intervention itself, the user, the organisation, and the context), it remains important that the use of quantitative and qualitative approaches are innovative (Headley & Plano Clark, 2020). We use mixed methods in this study to reflect the mechanism of interactions between different levels being investigated.

Furthermore, while it was argued that the integration between qualitative and quantitative data depends mainly on computational techniques by quantifying the qualitative data and then using statistics-by-themes or side-by-side comparisons (O'Halloran et al., 2018), this study extends the research by using a digital mixed methods design, where there is a large amount of sociocultural data that is easily gen-

erated and captured throughout this START intervention. There is limited research that employs mixed methods in intervention studies that use learning management systems to collect research data (Turnbull et al., 2020). Mixed methods research encompasses difficulties in integrating results from data analysis to reach meaningful findings (Bryman, 2007). Perhaps this study presents other difficulties not only because it involves mixed methods, but also because the study is totally conducted online where there are also rich quantitative and qualitative data that are easily generated from each module and through each cohort of trainees. Using Chamilo LMS to host data collection helps in overcoming some of these difficulties and will shed some light on using LMS beyond managing learning content.

Although it is too early to outline enhanced skills (English, business, and computer/ICT) for Arabic-speaking residents, this study, so far, has contributed to design-based research in many ways. Developing an intervention that aims to enhance business and computer skills simultaneously in a translanguaging and language-supportive environment has not been conducted previously. Furthermore, the e-business project phase, which blends the development of computer, business, and English skills, has not been investigated previously. This research contributes to design-based research as there is a lack of knowledge of its application beyond formal education in adult learning. Previously most design-based research has been applied in formal face-to-face settings or blended mode, but this study is conducted totally online. Moreover, as discussed in this paper, the results of data analysis will not only help refine the START intervention for these Arabic-speaking migrants, but also may draw some insights into the applicability of adjusted interventions to suit other disadvantaged cultural groups – provided they have a similar skills shortage.

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