# Combining Artificial Intelligent Techniques to Assist Language Education

Matthew Montebello and Vanessa Camilleri
Intelligent Computer Systems Department, Faculty of ICT, University of Malta
Email: matthew.montebello@um.edu.mt, vanessa.camilleri@um.edu.mt

***Abstract*—Communication is a crucial and indispensable necessity that every individual cannot do without in a modern society. In order for a number of persons to successfully and effectively exchange verbal information the use of comprehendible language is not only critical and essential but also fundamental. The language barrier experienced for a variety of reasons is not a straightforward hurdle but challenging, frustrating and arduous to overcome without sufficient assistance. In this paper we present a simple language gateway with an intelligent interface that offers personalised pathways driven by the specific learner profile to optimise both the learning process and environment.**

***Index Terms*—adult education, illiteracy, learning a foreign language, web-based education, personalised learning, user profiling**

## I. Introduction

Verbal communication is what distinguishes mankind from other living creatures as other audible and non-verbal means are all too common as basic behaviour in all animals. The ability of a human to articulate words, phrases and sentences to effectively communicate with another human is learnt as part of a semiotic process where as humans we attempt to make meaning out of all that is around us. Children posses an innate predisposition to acquire language skills as they are exposed to that same language [1]-[3] and master one or more natural languages with an ease that leave adult counterparts envious as they require practice, time and grueling dedication [4]-[6] The use of language is a convenient and most efficient way to communicate as we convey what we need to say and how we feel. Parikh [7] compares language use to a handling of a spoon as a tool fashioned by man, and as a sophisticated device a person possesses to perform a plethora of verbal operations like issuing commands, query others, and employ as a medium to pass information. The author specifies also that this tool suits every human's endowment and the world s/he lives in. As a matter of fact man has "shaped this tool to suit his ends and as such, it bears his marks and the marks of the world which it is about" (Pg. 1).

Language is also an essential factor in education as children who are old enough to attend schools are exposed to numerous subjects, disciplines, and educators. The main communication medium employed at any age is through language and as the corpus of academic terms and expressions conveyed orally and/or through documents continue to escalate students become even more dependent on the language of such sources. "Through naming, describing, classifying, and modifying things and ideas knowledge is extended and the command of language developed" [8] (Pg. 3). Additionally [8] goes on to point out that only through language that students are able to acquire and accrue new knowledge. As a matter of fact Pinnock [9] reports that amongst the numerous reasons why numerous students drop out of schooling is not due to intellectual, financial or physical reasons, "but by the decision to teach in a language which they do not understand" (Pg. 6). This further reiterates the importance of language and crucial to a person's communication proficiency. Language is not only the crux of communication but even more it's a requisite skill and a decisive instrument to be able to optimally function and thrive as an integral part of society.

The rest of the paper is organised as follows. The next section delves into the language barrier issue in the context of adult education as similar systems and related research projects are reviewed. Learner profiling and personalised learning environments are covered in Section III as they apply to the proposed prototype. This is followed by a full coverage of the prototype itself that was developed to be used in an empirical study. Section V delves into the details about the testing performed together with an analysis of the results as a product of a number of data collection instruments employed. The paper comes to a close as future work and conclusions are drawn in the final section.

## II. Language Barriers

Any kind of difficulty or obstruction that results in a lack of communication due to the use of language or while speaking more than one language, is figuratively known as the language barrier. Osae-Larbi [10] attributes this virtual obstacle to the multicultural state of society in general, especially with the increased frequency in global migration. Usunier [11] even more, attributes the use of a different language as the main feature to distinguish people from diverse cultures. As a matter of fact he states that "in the universal process of cultural harmonization,

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the role of language will remain intact as a key differentiator, while other sources of cultural differentiation will progressively disappear" (Pg. 167). To such extents some linguists [12] also agree with this assertion that a different language not only ethnically separates a person or a group of people from others, but also distinguishes their identity apart from others and thereby creating a gap or a barrier. Others, like Lauring [13], also link language to a person't identity, and highlight the need to appreciate and emphasise the importance and relevance of the relation between language, culture and social identity patterns [14]. And this is what is most important when tackling the language barriers issue, not to ignore or underestimate this close relatioship between language and the element of culture. Thereby it is imperative to keep in mind that for any system that attempts to teach a foreign language to a person of a different culture it needs to be tailored and customised to the cultural context of the target audience. Xie [15] stresses this matter by pointing out that it is a common mistake to disregard culture as not being a key aspect of language, and insists that its imperative to "learn the target culture" (Pg. 47).

Before delving into the techniques employed to capture the learner profile including the cultural and social aspects, it would be worth visiting the predisposition of technology itself to teach a language. Even though some researchers [16]-[18] believe that student engagement improves with the introduction of electronic teaching aids including computers and games, other e-learning researchers amongst which are O'Donoghue, Singh, & Green [19], Olson, *et al*., [20], and Noesgaard & Ørngreen [21], report motivational issues amongst students. Learner motivation could be affected by a number of issues but the lack of enthusiasm usually results from either learners who lack determination, or simply are not interested in the subject matter. Attempting to engage learners with the educational content by rendering it relevant to them and relate it as closely as possible to their own interests, backgorund and enviroment has been investigated by Tang & McCalla [22] where they highlight the importance of learner feedback in order to offer in return course materials that motivate further individual students based on their personal profile. Motivation is an important issue in every learning situation but in regards to e-learning the need for learners to be self-determined is even greater. As a matter of fact the self-determination learning theory is traditionally coupled with the corresponding learner profiling approach to address motivational issues [23]. This will be further expanded in Section III.

The self-determination learning theory brings into perspective the crucial role of learners that now need to be self-sufficient when learning a new language and not be dependent on educators. A paradigm shift in the role of educators from hand-holding teacher-centred approach to a facilitator approach based on student-centred ideology. This facilitating role is not easier or less engaging or demanding but only different and more effective [24].

Another issue to consider regarding the use of technology to teach a language is the possibility that such a medium offers to learners to form part of a community, a group or a network. Researchers like Gillespie [25], Murphy [26], and Leone [27] emphasise the importance of a learner support system made up of social connections and online resources that they can access, use and share. This learning network is unique to individual learners as it evolves over time and through continuous interaction that will eventually contribute to the personal and professional development and knowledge. Personal learning networks are firmly set within the connectivism learning theory and their ultimate goal is to empower learners and educators by building a personal community of peers and knowledge providers online in a way to share, collaborate and source information, ideas and knowledge. The potential of having a massive online knowledge base at one's fingertips is intense and overwhelmingly powerful that is sometimes overlooked and not taken advantage of. To build such a network a person needs the adequate tools, social networking tools, to be able to connect and interact with other web users who likewise are developing their own personal network. Every individual can decide on the way to go about extending one's network while at the same time defining the way to learn, what to learn, and at which pace. Such networks automatically promote collaboration and sharing thereby fostering a communal sense of belonging and non-isolation. Developing a private learning network is not a simple task or a decision following an impulse to do so, but a mind-set and a way of life. It is a conscious choice of continuous learning, a dedication to search, collect and curate interesting information, and a passion to create, distribute, share and collaborate with other like-minded people while employing the Internet as a communication medium. Typically a minimal set of tools and activities required for a personal learning network require one or more social networking accounts to link up and communicate with other social networkers who have similar interests and needs; follow, contribute and distribute content discovered or generated over a blog, a wiki or any other social bookmarking online tool; join and participate in discussion groups, fora and other social gatherings to acquire new information while at the same time sharing personal knowledge with others. Much of these online tools have been made available and are possible through the advent of Web 2.0 technologies [28], [29] that characteristically present dynamic rather than static websites displaying user-generated content.

Another issue worth keeping in mind when considering social networks in conjunction with language education is the element of student engagement in relation to the connectivism learning theory. Studies have clearly showed that there exists a direct correlation between social networking and engagement. Junco, Heiberger, & Loken [30] have statistically confirmed, through analyses of Twitter communications, that "students and faculty were both highly engaged in the learning process in ways that transcended traditional classroom activities" (p.1). Their study provided "experimental evidence that Twitter can be used as an educational tool to help engage students and to mobilise faculty into a more active and participatory role"

 

(p.1). Similarly, Rutherford [31] has shown that there is a positive correlation between student use of social media and the quality of their educational experience. The study gave positive insights into the impact the use of social media can have on the level of pre-service student engagement. Other studies [32]-[34] have also shown that leveraging social networks during the educational process enhances student engagement. They provide the required connections between users thereby facilitating communication, collaboration, and collective learning at the same time.

## III. Learner Profiling to Personalise Teaching

Learner profiling and the use of individual personal learning portfolios have been employed to personalise the learning environment [23]. Gooren-Sieber & Henrich, [35] talk about a collection of a student's work that characterises her/his academic record. The authors argue that such portfolios have evolved over the years from traditional physical learning portfolios to the e-learning domain in order to personalise learning. Lorenzo & Ittelson [36] describe such portfolios as valuable learning tools that go beyond the simplicity of an electronic collection of student artefacts. As a matter of fact the authors identify six categories of personal learning portfolios amongst which is a learner profiling functionality that employs the portfolio to plan educational content in line with the unique characteristics of the student. To this extent Daunert & Price [37] suggest that, based on latest research, personal learning portfolios are "practical tools for supporting self-directed and reflective learning" (p.231). This is confirmed by other studies [38], [39], [35] that highlight the escalation of student enthusiasm to further participate and take initiative in their learning process. In this respect Yongqiang & Jinwu [40] attribute cognitive improvement, a rise in individualised learning, and overall improvement in the e-learning medium. Furthermore, Daunert & Price [37] state that portfolios also support collaborative learning whereby learners share their work and resources for educational purposes. This is perfectly inline with the personal learning network concept discussed in the previous section. D'Alessandro [39] also highlights this coupling as he concludes that through the use of personal learning portfolios within a personal learning environment learners are able to capture and manage their knowledge status. Furthermore, the author remarks that the educational process can improve if the same learners socially engage and strike connections within their peer community to discuss, contribute and share content. The close correlation between learner profiling and personal learning portfolio is also acknowledged in the research reported by Guo & Greer [41] who confirm that personal learning portfolios are ideal sources of information to initialise learner models that are eventually employed to create adaptive educational material. They highlight the benefits of learner profiling and how such an approach is strategic to reflective and personalised learning. A learner profile contains specific and essential information related to the academic persona of a unique student. Such profiles represent a direct mapping to the distinctive characteristics of individual students as they differ in their academic background, interests, preferences, and learning goals. The student could be initially asked to explicitly declare the specific qualities, descriptions or characteristics that can be employed to develop the profile. On the other hand, numerous simple learner profile generators automatically develop the required profile that can be used to personalise the service being rendered [42]. A well-known and basic issue with automatic profile generators is the inability to produce a profile at the very beginning of the process when no previous information about the learner is available. This problem commonly referred to as the 'cold start' effect [43] can be easily and quickly addressed by adopting the explicit collection of learner interests and needs at the beginning of the process, and eventually employ automatic profile generation from then onwards. The initial explicit method generates enough information and momentum for the automatic method to seamlessly take over the process and effectively generates a learner profile that can be productively used to personalise the content. The content that is presented is highly dependable on the application area under consideration together with the reasons for doing so. In the case of online information systems like newspapers the generated profiles would characteristically contain the reading habits and patterns together with topical items the readers are interested in, while ensuring not to include others that they dislike. Another domain dependent example is a personal scheduling system where the profile generated ensures to take into account not just the date, time, venue and participants, but also personal priority issues together with re/scheduling habits and patterns. Within the academic domain the profile generated encapsulates as much as possible the comprehensive learner characteristics that deal with knowledge, interests, and educational needs. In this respect a learner profile is considered a collection of inferences about information concerning a student that one is not able to observe [44]. The main use of the learner profile is to adapt and personalise the learning process as well as the content and the delivery of the educational material. An automated learner profile can be generated using Computer Science techniques and as a matter of fact Li & Wei [45] developed one such prototype to help learners acquire vocabulary terms. They employ a Time-decayed User Profile (TUP) to capture individual characteristics of each individual learner. The authors conclude that further to their work, a user-friendly interface is required to complement the educational benefits rendered by the user profiling techniques.

## IV. Intelligent Pathways

Learning pathways is a prototype e-learning system that was developed as a proof of concept to investigate the effectiveness of employing the techniques described in the previous two sections. The main concept behind the proposed system is to customise the language learning process through a merge of techniques and methodologies based on solid learning theories. The effectiveness of the prototype is under investigation and whether such an e-learning environment reduced the language barriers that were discussed earlier. The five techniques employed will

 

now be tackled one at a time in the following subsections.

### A. Personal Network

The personal network being referred to here is not the personal area network that is traditionally referred to as a communication network for the devices of an individual. In this case we are referring to an educational network of a learner whereby all the personal contacts, online resources, and points of reference are brought together. Such an academic support system assists the learner to take better advantage of any possible resource to optimise the learning process. As mentioned earlier the Connectivism learning theory, evidenced in the use of social networks and online sources, provided the supplementary content to accompany the language resources that were employed as teaching material. This content provided the context and the required personalisation in collaboration with the other techniques that will be presented to optimise the e-learning experience.

### B. Learner Profiling

The self-determination learning theory introduced earlier in Section II is at the basis of employing user profiling technique as learners are required to interact with the system to ensure the profiling mechanism functions as it is supposed to and refines the same learner's profile over time and frequency of use. The generated profile was employed to selectively identify resources from the learner's personal network and present it within the intelligent user interface. The use of additional techniques in combination with the profiling functionality, adds value to the proposed e-learning experience that traditional e-learning environments fail or are too static to provide.

### C. Subtitling

The use of subtitling all the resources provided was proposed and implemented due to the particular domain that was being taken into consideration. A number of studies [46]-[48] have shown that learning a foreign language is highly simplified by the use and practice of following and reading subtitles at the bottom of a TV screen or at a cinema. Almeida & Costa [49] further propose additional ways of how to augment the use of subtitles as a learning teaching aid. They conclude that a language learner has to be deeply active in the processes of guessing, verification of meaning, metacognitive questioning and inference to take full advantage of the use of subtitling. Borras & Lafayette [50] also agree that subtitles assist in developing language proficiency as such practice enables "learners to be conscious of language that they might not otherwise understand" (Pg.61). The authors provide empirical evidence about the positive effects of such a methodology during transactional task practice with multimedia courseware and a high correlation between the learners' communication skills and the combination of subtitle use and task level. Danan [51] emphasises the pedagogical significance of subtitles and captions to improve listening skills of second language learners. The author points out that "captioning facilitates language learning by helping students visualise what they hear" and "subtitling can also increase language comprehension and leads to additional cognitive benefits, such as greater depth of processing" (Pg. 67).

### D. Natural Language Processing

Learning languages and technology merge very well within the domain of natural language processing. The fact that text can be audibly synthesised and employed to teach a foreign language has great potential especially within such an e-learning environment. Resources that are not only subtitled but also automatically translated from a foreign language to the learner's preferred mother tongue adds not just value but quality as it places all available resources in one's personal network accessible. Such functionality broadens both the range of resources as well as the range of the learner's personal network. DARPA, the Defence Advanced Research Projects Agency, needed to ensure to collate information from around the world in a variety of languages and makes use of natural language processing that can find, pinpoint, and manage information from heterogeneous online sources in numerous languages [52]. In this case a learner does not need to parse through a plethora of information in different foreign languages and in different forms like text, audio, and video. Guess [52] reports about a program manager at DARPA, Dr. Bonnie Dorr, who stated that "what's of interest there is gleaning information from the huge volumes that come through to us in foreign languages". The potential of this technology, especially when applied to the area of information retrieval, is being applied to identify resources online in different foreign languages.

### E. Intelligent Interface

The fifth and last technology brings together all the other four that have been described in the previous subsections. The intelligent interface was meant to reflect the learner profile generated and display the language resources through the same learner's personal network. Wilson [53] proposes a methodology whereby the teaching environment is tailored to the different needs and requirements of individual students. She continues by precisely stating what is required to do so, namely, a precise way of generating a learner profile, and a course content developed to reflect the generated learner profile. The interface proposed for the learning pathways incorporates precisely the two elements identified by Wilson. Additionally to ensure that the cold start issue discussed earlier is taken care of, a default course setting is presented to the learner and tailored with the initial explicit user input involving topical interests and domains. The full details of the resulting prototype together with the empirical study that was held to measure the effectiveness of this e-learning environment will be presented in the following section. This will shed light on the technologies employed but also on the overall use of technology to reduce the language barrier and offer different language pathways to the individual learners.

## V. Empirical Study and Results

The empirical study was performed on an existent system [23] that was specifically adapted for this study.

 

The intelligent personal learning environment was developed as a generic platform to accommodate any particular domain and to adapt to the different learners enrolled. The platform is also founded on the same principles mentioned earlier. The learner's personal network was saved on the server side with a reference on the client side using traditional cookies. Use of social networks to accumulate supplementary resources related to the learners' interests and needs was executed using Twitter, Facebook, and Google hangouts. The profile generation component was performed using case-based reasoning [54] that makes use of previous cases that are similar to the current problem at hand and applies or adopts the solution to the situation. So, given a student who has a problem with understanding a particular language issue, the case-based reasoner retrieves relevant cases that match such a request and adapts solutions that were effective to solve the similar problem. The difficult part for the classification task arises when the system is required to identify a target class for a case that has no classification. In such instances the solution to this dilemma is simply fitting the class that is most similar. Case-based reasoning has been employed as a learner profile generator in various customisation scenarios like web information searching [55], topical filtering of data [56], and document clustering [57]. The subtitling process was performed using open source natural language toolkits for three languages, namely French, Italian and Spanish. The choice of these three languages was influenced by the sample of participants that provided data to the empirical study, but also not to over complicate the study itself. Since the backend was developed in Python it was very easy to integrate the functionality of the NLTK version 3.0 toolkit [58]. This leading platform is ideal for Python-based development environments that require human language processing and has been employed in similar projects [59], [60]. NLTK provides easily accessible interfaces that employ numerous corpora, lexical resources like WordNet and DBPedia. It also includes a rich set of text-processing APIs that can easily classify, tokenise, stem, tag, parse, and semantically annotate. The intelligent interface and the dynamic customization that each learner interacts with was developed further using Python. The language academic resources were adapted from the TEFL language foundation course [61] that is freely available and that is widely used in local private institutions. The empirical study took place during the month of August 2016 while numerous foreign teachers from France, Italy and Spain visit Malta to learn how to teach English as a foreign language. A local private language school accepted to allow two classes of approximately 20 students each to participate in the study with one of the classes acting as the control class. Participants at this language school are every morning given a brief introduction on their academic schedule for the day by a language instructor who introduces a new topic every morning for two weeks. This lasts for 45 minutes after which the student teachers are expected to follow an online instructional course for 90 minutes, stop for a lunch break, and follow another 90 minutes of online instruction in the afternoon. At the end of the day the participants meet the language instructor once more to summarise the academic content covered and complete a written language task that will be assessed. An oral assessment is done twice a week which is also assessed by the language instructor to further follow the progress of each student teacher.

The first class followed the standard online course that the school regularly administers to its students, while the second class accessed the Language Pathways environment. Both classes attended the morning face-to-face session, as well as the closing session together with the written and oral assessment tasks. The data collected from these tasks was used to evaluate the effectiveness of the Language Pathways environment and derive a number of conclusions presented in the last section.

TABLE I. TEFL FOUNDATION CERTIFICATE LEARNING ACTIVITIES

| Week 1 |
|---|
| • Teach English as a foreign or second language online<br>• Manage Online Conferencing Systems<br>• Create a Course Syllabus and Learner Outcomes<br>• Create Course Materials<br>• Perform a Course Evaluation |
| **Week 2** |
| • Control Course Management<br>• Access and manage both ready-made materials and those you have created yourself<br>• Create a portfolio of materials for a variety of lesson types<br>• Apply for an online teaching post at an established school<br>• Set up your own online teaching business |

Both classes were exposed to identical course materials, activities and assessments, while the academic content was supplemented, in the case of the Learning Pathways environment, with additional information from the social networks and from other online sources that have all been enhanced with the techniques expanded in the previous section to fit within the intelligent personal learning environment. The table below shows the learning activities that were covered during the two weeks of the empirical study.

TABLE II. LEARNING PATHWAYS EMPIRICAL STUDY

| Week 1 |
|---|
| • Pre-study questionnaire<br>• End-of-day assessment<br>  ○ Written – Monday, Wednesday, and Friday<br>  ○ Oral - Tuesday and Thursday<br>• End-of-week questionnaire – Saturday |
| **Week 2** |
| • End-of-day assessment<br>  ○ Written – Monday, Wednesday, and Friday<br>  ○ Oral – Tuesday and Thursday<br>• End-of-course exam - Saturday<br>• Post-study questionnaire – Saturday<br>• Focus groups – Saturday |

All the participants were administered the full set of measuring instruments to collect data in order to compare the results of the Learning Pathways participants with

those of the control group. The table above shows the full schedule of the empirical study.

The pre-study questionnaire covered several areas about the participants to capture a good snapshot of their demographics but also of their prior knowledge about the topics to be covered, as well as about their attitudes towards e-learning in general and their interests and hobbies. The assessments during the two weeks were related to the academic content, while the post-study questionnaire and the focus groups dealt with the Language Pathways methodology and the use of the different techniques.

The table below shows the demographics of the participants within both groups. The distribution shown here is considered typical according to the institute's administration who have been organizing such courses for these last 15 years.

TABLE III. PARTICIPANTS DEMOGRAPHICS

| | Learning Pathways Group | Control Group |
|---|---|---|
| Total Number of Participants | 20 | 19 |
| Age Ratio (< 30 / ≥ 30 / 50+) | 3 / 15 / 2 | 2 / 16 / 1 |
| Nationality Ratio (French / Italian / Spanish) | 5 / 12 / 3 | 4 / 10 / 5 |
| Gender Ratio (Female / Male) | 16 / 4 | 15 / 4 |
| Teaching Experience (< 10 years / ≥ 10 years) | 15 / 5 | 16 / 3 |
| Knowledge of English (Understand / Read / Write) | 1 / 1 / 18 | 0 / 2 / 17 |
| e-Learning Experience (Never / < 3 / ≥ 3) | 2 / 17 / 1 | 3 / 16 / 0 |

The effectiveness of the Learning Pathways was assessed through the outcome of the participants when they were asked to evaluate the effectiveness of the course at the end of each week, in combination with their academic achievements. Answers were recorded using the Likert scale that uses a five-point scale to allow participants to express their reaction to specific statements made. This scale assumes that the intensity of a user's experience is linear from 1 (lowest) to 5 (highest) and that attitudes can be measured. The table below shows the results of the participants' performance together with their evaluation of the medium employed.

TABLE IV. RESULTS

| | Learning Pathways Group | Control Group |
|---|---|---|
| Initial Written / Oral Assessment | 62% / 75% | 65% / 73% |
| Week 1 Written /Oral Assessment | 60% / 75% | 65% / 72% |
| Week 1 e-Learning Effectiveness | 3.5 | 3 |
| Week 2 Written / Oral Assessment | 70% / 83% | 68% / 80% |
| Week 2 e-Learning Effectiveness | 4.1 | 2.8 |
| End-of-Course Exam | 85% | 80% |

The weekly assessments are averages taken over the week and reflect the participants' progress, while the participants' attitude towards the e-learning environment was extracted from the end-of-week and post-study questionnaires. The end-of-course exam was identical for both groups and was the original exam that the educational institution administers to all its students at the end of the program. The results show a steady improvement in both cases with a slight edge on the Learning Pathways side. During the focus group sessions the participants gave very good feedback when questioned about the use of subtitles and showed satisfaction at the use of content related to their interests. Some of these student teachers within the Learning Pathways group also expressed a sense of surprise when they realised that the interface was somewhat adapting to their previous actions and feedback, while others in the same group either did not notice or the time period was too short for the profiler to make any difference. However at the end of each day, during the weekend and during social outings the students did share experiences and numerous participants from the control group started asking and commenting about subtitle-enriched material. This did not happen as much as on the learner interests and profiler personalization effects, which seemed to have a weaker effect.

The average final score of 85% for the Learning Pathways group was higher then the 80% for the control group, however the statistical t-test signaled no significant difference ($p < 0.05$) between the groups. The participants' outlook towards the medium employed gives an interesting indication of what the Learning Pathways group was experiencing. Whereas the mean value increased from 3.5 to 4.1 (Likert scale 1 – 5) for the target group, the mean dropped for the control group who might have realised they had a standard interface and that the other group had some added-value within their environment. The control group reported during the focus group session that they got used to their static environment and even though they still improved their academic performance, they dropped their appreciation towards the medium used.

## VI. FUTURE WORK AND CONCLUSIONS

The empirical study reported in this paper aimed to investigate the effectiveness of the Learning Pathways e-learning environment that incorporated the amalgamation of a number of techniques, namely, personal learning networks, learner profile generation, use of subtitles in language education, natural language processing, and intelligent learner interfaces. The study was performed with a convenient sample of higher education students over a period of two weeks, and the resulting outcome was encouraging. Isolating the control group from the target group could have potentially altered the outcome of the results for the control group as they were influenced by the activities of the participants within the other group. On the other hand if more time for testing was available, a much more rigorous evaluation plan would have been implemented. Ideally both groups experience both the Learning Pathways medium and the

 

standard e-learning thereby being in a better position to assess and appreciate the difference. This study has contributed to a number of domains in multiple ways. The successful combination of techniques towards a common goal while adding value and effectiveness is worth noting. Additionally the use of subtitling within a foreign language program has been reinforced, while the use of dynamic personalization techniques in tandem with the use of online resources and social networks has been investigated and tested.

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**Matthew Montebello** is an associate professor and head at the Department of Intelligent Computer Systems at the Faculty of ICT, University of Malta. He heads the Agent Technology Research Group at departmental level, as well as coordinates a number of Interest Groups within the same faculty. Before joining the University in 1999 with a PhD in Computer Science he was already heavily involved in Education in secondary schools after graduating in 1990 at the University of Malta B.Ed.(Hons) degree. Having obtained an extensive teaching experience and having been involved with the introduction of computer labs through the Ministry of Education, he proceeded to follow the Computer Science domain when he pursued his post-graduate studies obtaining a Masters and a Doctorate at the Cardiff University in Wales.
Apart from his academic interests, Prof Montebello nourishes a common interest with local Marine Archaeologists and in 2010 read a Masters in the area at Ulster university in Ireland. He regularly assists the department of Classics and Archaeology at summer field schools and education forums about use of ICT in deep diving especially in relation to local marine archaeological heritage. In the past (2004-2014) he was also heavily involved in protecting and promoting the individual and collective interests of academic staff at the University of Malta as member, general secretary and president of the academics' union, UMASA.

**Vanessa Camilleri** lectures at the Faculty of ICT. Her work is in the area of human-computer interaction, virtual reality applications, and serious games. Before she joined the Faculty of ICT she lectured at the Faculty of Education, where she was teaching Computing in Education, as well as Educational Technologies (including open education, and eLearning) for a number of years. These experiences have contributed to Dr Camilleri's strong beliefs in inter-Faculty collaboration. She is also a great believer in quality Education that is a key factor for success in today's world, and that is further enhanced by the digital possibilities and technology applications that are driving much of what makes up our society. Her publications are mostly in the areas of autonomous learning projects and possibilities and her current research interests are in the field of Virtual Worlds for Education and Serious Applications. She is also involved in 2 funded projects that deal with the the use of games for learning. Together with teaching, research constitutes a very important component in Dr. Camilleri's academic career. However this doesn't deter from where possible contributing to the Faculty's other administration duties such participation in sub-committees.

 