Gaming to learn: language in a clinical context

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Abstract: This chapter articulates the rationale for Medicina, a games-based learning module for international students in the Bachelor of Nursing. On a basic level, the game gives students the opportunity to iteratively practise their language skills by identifying written words to match aural stimuli. However, the game is much more than this: its design uses the insights of constructive alignment to develop an activity and informal assessment to promote deeper learning, and engages students' "projective identity" in order to shape them for their future workplace. Some qualitative student feedback responses are also presented to support the discussion.

Keywords: language learning, constructive alignment, projective identity

Introduction

Medicina is a game-based learning environment for non-native speakers of English who are studying nursing in Australia at Flinders University. The game enables students to learn the names of specific medications, which are particularly difficult for international students. An important outcome of all nursing school curricula is competent communication, and *Medicina* is a teaching/learning activity designed to help meet that aim in a manner that is not available elsewhere in the curriculum.

The problems associated with international nursing education are significant as outlined by Müller (2011). A meta-synthesis of qualitative studies found the lack of language skills of EAL students to be the primary challenge for nursing education. Starr finds that language difficulties in all skill areas was common in the studies she reviewed (2009:482-3). Blackman *et al.* found that better language equates to better overall academic performance (2007). Indeed, it has been observed that "many times the academic problems are directly related to language problems", which also directly affect students' clinical performance (Guhde, 2003:113-114). Chiang & Crickmore

also report that post-graduate EAL students feel they lack particular communication skills necessary for their clinical placement (2009:330). Any intervention designed to address these challenges needs to examine their cause more closely.

To address EAL students' listening and reading needs, vocabulary needs to be expressed in a spoken format, and simultaneously accompanied by its written form. There also needs to be repeated opportunities for listening- and reading-based interaction with these words if automaticity is to develop. The action of *Medicina* involves the student watching a digitised simulation of the clinical environment (a hospital), listening to a command to find a particular medication, and using the mouse to select the correct option among five bottles with different names written on them (see Figure 1). Once a choice is selected, it is given to the virtual nurse who says either "Yes" and repeats the correct name or "No" and pronounces what the incorrectly chosen name sounds like. One of a number of nonverbal visual scenarios is shown in a thought bubble coming from the avatar's head: a patient happily sleeping, a patient who turns green and vomits, and a patient whose head enlarges into a tomato and explodes.
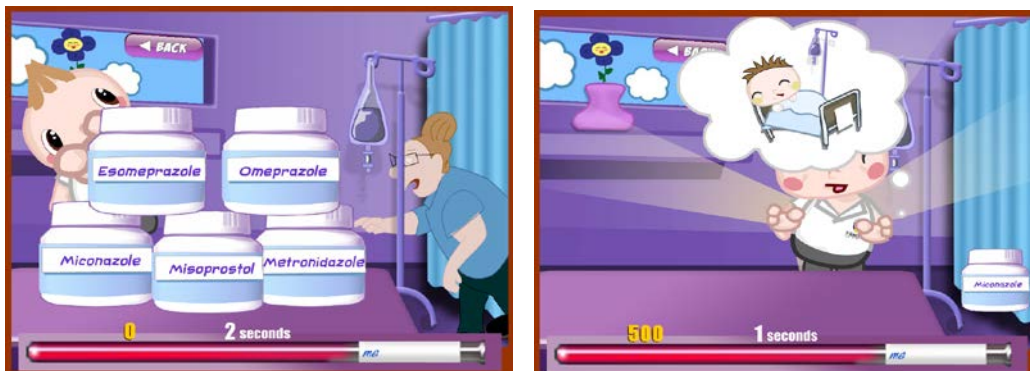

Figure 1: 'Selecting an option' and 'correct' screenshots.

The student has four seconds to complete this process of selection, after which four seconds of feedback is given about their choice, and points accumulated for correct answers. Not selecting an option, or choosing three incorrect answers, ends the game. Scores and usernames are displayed on the game's common scoreboard. There is an accompanying click-and-play list of medication names used in the game, the "*Medicina* Cheatsheet", which is an important educational resource that supports the game when the student is too challenged and needs help.

In terms of student experience and the learning environment, *Medicina* differs markedly from traditional classroom (or even clinical) practice. Students have the opportunity to play the game in a lab, or at home, or anywhere that suits them. They develop a simple avatar (character) with a gender and name who then accrues points as they play. Students can play alone or together, and they can try again and again and self-regulate their own learning. A key element of the game is repetition, so players can try as many times as they need to develop mastery of the requisite vocabulary. This is learning that is fun, informal, engaging, contextualised and focussed: with *Medicina*, students are "playing their education" (Cermak-Sassenroth, this volume).

Medicina is based on established theories of learning as applied to a specific learning context, as recommended by Whitton (2009). It is designed along the lines of constructive alignment, an outcomes-oriented approach to curriculum design intended to promote "*deep learning*" (Biggs, 2003). *Medicina* also implements Gee's notion of "*projective identity*" (2007a). *Medicina* offers both a female and male avatar for students to select to represent themselves in their game (see Figure 2).

Figure 2: The Medicina *avatars*

When learning through *Medicina*, students are also players and their individual identity melds with the digital identity of their avatar, developing a "*projective stance*" which is particularly useful for learning essential aspects of a professional identity (Gee, 2007b). In this way, students are able to test out their new identities as nurses in a hospital ward, yet in a learning environment which is safe because they are able to learn from making mistakes which have limited consequences. The game will be shown to play a preparatory-maintenance-remedial role that supports the curriculum by creating projected identity and improving student motivation while engaging in

curricular content. To support this, a qualitative survey of students was conducted to ascertain their opinions on what *Medicina* means to them and how it has affected their knowledge, study, and motivation. Their comments are reported in this chapter and will provide support for the further development of digital game-based language learning among international nursing students.

Vocabulary size, acquisition, and academic success

It is important to have knowledge of the vocabulary related to topics of communication. Once a person has these "words" they will better understand what is being discussed or written about, and it follows that the active skills of speaking and writing should also improve. Although this is common sense for all language users, it is a particular challenge for non-native speakers undertaking academic study.

The question to address at this stage is the amount of vocabulary needed to succeed in academia. Schmitt (2008:331) concludes in his review of the second language learning literature that a learner must know about 98% of words in a written text or spoken script to fully understand it. In addition, Hazenberg and Hulstijn (1996) estimate that, for academic purposes, students need to know at least 10,000 word families, or groups of words that are inflections or derivations of a single root; for example, the root word 'slow' has 'slower' and 'slowness' in its word family. English as an Additional Language (EAL) students may have a vocabulary knowledge much lower than 10,000 word families: Laufer (cited in Schmitt, 2008:332) estimates that Chinese English majors have a vocabulary of only 4,000 words.

Sophistication in vocabulary knowledge is connected to academic performance. A study by Daller and Xue (2009) examined the relationship between vocabulary knowledge and academic success. They found that lexical sophistication (vocabulary knowledge that extends beyond commonly used English words) is more closely correlated to academic success than standardised measures of language proficiency such as International English Language Testing System (IELTS) scores. Indeed, lexical sophistication accounted for 40% of the variance in the number of failed academic modules, and the number of low frequency "difficult" words at the disposal of a student correlated with academic success by -.565 (p=.004) (Daller & Xue, 2009:192-3).

The acquisition of vocabulary is highly problematic since it is a specific process of cognitive actions rather than a single act of memorisation, and it must be an intentional activity. Incidental

learning is repeatedly found to be less effective than explicit learning (Schmitt, 2008:333-341). Within this intentional learning framework, students can repeatedly listen to medication names and then relate these words to their written form. This opportunity is not found elsewhere in the curriculum, yet it is so important to vocabulary acquisition. It gives EAL students access to "*adequate levels of language experience*" Benzie (2010:447) not available elsewhere.

Indeed, a lack of repeated exposure is an underlying contributor to poor vocabulary knowledge and fluent language reception and production. A lack of exposure has also been flagged as an important factor in language acquisition in the nursing literature. For example, EAL students have reported difficulty with listening partly due to the low-frequency vocabulary found in the health field (Shakya & Horsfall, 2000:165). Reading does allow for repetition, but it is often a slow process for EAL students. Despite this, EAL students have been observed to repeat-read a text up to five times (Donnelly *et al.*, 2009:205). Similarly, one study found that when speech was recorded, students listen to these recordings multiple times and practice their pronunciation in private (Guhde, 2003:115).

Research shows that, without repeat exposure, EAL nursing students are unlikely to attain the language automaticity required to support academic success and good clinical communication. Hulstijn argues that "*automatic word recognition*" is essential for fluent language use (2006:711). The familiarity gained from repeated exposure means that the student spends less time recognising, or recalling, words and this allows them to concentrate on other tasks, such as performing clinical activities. Unfortunately, though, many students do not have sufficient levels of language automaticity at their disposal and their performance suffers as a result. For example, in one paper, students reported that their difficulties with listening lie mostly with the speed of delivery (Shakya & Horsfall, 2000:165). Another reason cited for difficulties with listening is that it is "*not always possible to have verbal information repeated*" (Shakya & Horsfall, 2000:165). Thus, as Donnelly, McKiel, and Hwang (2009) point out, students miss out on important educational input. This leads to the central issue that students need better preparation, and that is where the unique properties of game-based learning emerge. This is because games allow the EAL nursing student to get the kind of repeated exposure to context-focused language that they require.

Medicina focuses on one set of key vocabulary items for the professional field – medication names – and provides repeated

exposure to both the verbal and written forms. The game draws solely upon the Prescription Benefit Scheme list for current Australian medication names (DHA, 2010a), and focuses on medications known to be confused by nurses in clinical settings (ISMP, 2010; Hicks *et al.*, 2008; Australian Council for Safety and Quality in Health Care, 2002:75-7; Chi, 2008:3). Indeed, a key aspect of the game is its purposeful grouping of medication names according to sound and spelling similarities (homonyms). For example, confusions between "pethidine" and "betadine" are elicited, because in real life such a confusion can have fatal consequences. It also includes some of the most commonly used medications in Australia (DHA, 2010b:13; DHA, 2007:24-6). This develops vocabulary skills that have direct relevance to clinical contexts.

Learning the language of the profession

Profession-specific words have particular properties: they are low frequency, they contain unique and specialist word forms, they are rarely found simultaneously in written and spoken forms for comparison, and they are not automatised. Therefore, students usually find them difficult. One might assume that learning profession-related words is, at least at the level of form, operating at the lower end of Bigg's SOLO taxonomy of cognitive activities, where learning outcomes merely involves the simple objective of identification (Biggs, 2003:66-7).

A learning activity that seeks to translate teaching into learning will transcend the basic aim of exposure and repetition. It is true that one of the beginning points of learning in this game is the type of repetition and recall that Whitton associates with language learning (2009:44), but it is also more than this. Good teaching can raise learning to a level higher than that gained from rote learning by incorporating higher level SOLO taxonomy tasks (Biggs, 2003:66-7). *Medicina* is designed to produce multistructural outcomes while demanding comparison between words and initiating the relational phase by relating previous knowledge about spelling and common word forms in a vocabulary subset. Finally, it develops the extended abstract abilities of generalising learned knowledge into new situations. This involves seeing connections and developing metacognitive skills that affect language skills beyond the particular words studied in the game.

These higher-order learning outcomes were evident among the student feedback for *Medicina*, where nearly all students commented that they gained familiarity with medication names. Students reported

that the game "*helped me to pick up the sounds in my class*"; "*medication names feel really familiar now*", and that the game "*helped in differentiating different word sounds*". It is evident that students developed metacognitive skills beyond rote learning, since they make comments such as "*when I heard the names before, I was guessing, but now I am listening and thinking*"; "*I know it is a medication by what it sounds like, so it relaxes me*", and "*I can recognise the medication word immediately, at least I know it's a medicine and not a disease or other thing*".

Furthermore, the game supports the curriculum because it produces better prepared professionals who have learnt the jargon, who are prepared for confusable medicine names, and have been familiarised with an authentic communicative context before encountering it in real life. One student says that the game "*helped with learning medicine names before actually going to clinical placement*". Thus, it prepares students for the communicative use of key vocabulary in classroom and clinical placement. Students remarked about how the game enhances their classroom experience: "*In class, the teacher uses the words and it quickly reflects in my mind and I know it is a medication*", and "*I hear more names in lectures and study. I now know more words in class and books. I catch up on what they mean*".

Even though *Medicina* is essentially a multiple choice quiz at its core, is that it combines a timed activity with multiple multimedia inputs that challenges the student to hazard a response or else the game ends. It is an immersive quick-paced challenge of the player's skills and the students like this aspect of the game. One commented that "*the speed of the game was really good. It was faster than I could do it so it could enhance my skill for catching the word. If it was slow I would never improve. It boosts me to learn more and more*".

Medicina promotes informal learning that provides task-focused, authentic learning experiences (Whitton, 2009:36). Many students gave feedback which indicates they felt it was a fun game rather than an onerous educational task, as evident in the following comments on how they accessed the game: "*just play around while having coffee or a break*"; "*do it any time when you rest*" and "*before you go to bed*". A student used the game to alleviate anxiety while they took time out of their busy schedule: "*Sometimes, I don't want to study so I play the game. I don't feel guilty because I won't waste time.*" If a game behaves more like a lesson than a fun activity, it loses this sense of relaxed informality.

Another important aspect of *Medicina* is it does not encourage the player to leave the immersive environment, for example, to check on a hyperlinked explanation of why they got something wrong. From an educational point of view, the teacher is no longer the expert who lectures to the student. Rather, the teacher becomes a facilitator of experiences where the student engages with the content in a fun, relaxed, but challenging environment where they are the centre of their imaginative world and they have to resolve their own mistakes through private research. This process of probing and reprobing (Gee 2007a) is another way through which *Medicina* is designed to transform teaching into learning, and it facilitates the "flow" that is so essential to learning (Csíkszentmihályi, 1990; Shute *et al.*, 2009). Note that the student can seek educational advice once the experiential episode is complete.

Medicina has a specific approach to vocabulary learning. Often the educational focus of games is on learning the meaning of new words. However, there are important linguistic reasons why this can be inappropriate to the learner's situation. Students who learn English as a foreign language need multiple exposures to a new word *before* meaning can be established. Students need to first form sounds into meaningful clusters, relate spelling to these clusters, become familiar with what the word looks and sounds like overall, and generally develop their schematic knowledge of the features of the word set. Indeed, about 10 exposures to a new word need to take place before meaning can start to be properly assigned to the word (Webb, 2007:62; Brown *et al.*, 2008:151-154).

Keeping this in mind, *Medicina* only focuses on this first step of vocabulary acquisition, relying on the wider curriculum to overlay meaning onto the learned word form. Once familiarity is acquired with the language medium, the student will be better prepared for authentic learning opportunities as they access the meanings and uses of medication names in the classroom, clinical placement, and textbooks.

An additional strength of *Medicina* is the game's use of Australian accents. Different variants of spoken English can have significant differences from the stress and intonation patterns of Australian English. This poses a problem for the Australian listener when the student speaks with two accents: their own non-English accent which uses a non-Australian pronunciation. The potential for misunderstanding is great. In *Medicina*, five female Australian English speakers of different ages were used to create the audio components. This strategy means that the students receive language help that takes into account the Australian clinical context. Furthermore, the students

themselves emphasise that the range of Australian voices is important to their learning. Students noticed "*the different voice types and reading speed*", which helped them realize how "*slight differences in the way a word is pronounced can make it so different*". They complained that "*when I checked medications online I got American accents, and it definitely confuses me. Medicina is more accurate, it is better than doing it online*".

While giving students the words of a profession does equip them for the linguistic needs of the curriculum, it also prepares students for the social context in which the language is used. To fully achieve participation, developing a language identity is important to language learners, and the use of an avatar is an answer to this need.

Building professional nursing identities

A major design strength built into *Medicina* is the demand for what Gee refers to as "*situated cognition*" (Gee, 2007a). Gee argues that thinking and learning does not happen divorced from context, but that cognition is strongly grounded in specific situations and contexts. Thus, a person will learn how to be a nurse better from activities and contexts germane to the clinical situation than they would in a classroom. This reinforces what we know about the context-specific nature of academic literacies in higher education (Lea & Street, 1998). However, *Medicina* does not just mimic the future workplace of nursing students, it helps to construct their identity as professionals.

Through the construction and development of an avatar in *Medicina*, students develop a "*projective identity*" (Gee, 2007a), an identity that is a combination of their digital avatar with their real-world identity. This blurs the boundaries of identity between player and avatar, student and nurse, and allows the player/student to project themselves into their future professional role in a safe, low-stakes learning environment. This identity occupies a "*projective stance*" conducive to the development of an "*authentic professional*", defined as "*a commitment to being in the world in a certain way with a certain style and operating by certain values*" (Gee, 2007b:105). This type of professional development is simply not possible through traditional teacher-led curriculum, but is activated through the type of facilitated learning that *Medicina* enables.

The use of avatars in *Medicina* is something the students particularly appreciated and saw as central to their learning experience. Students particularly commented on the motivation gained from using an avatar, revealing strong feelings about the matter: "*I wouldn't play*

the game if there was no character. It was like a cartoon of myself. It motivated my participation", or "*we really need the character in the game. It is really helpful to immerse in the situation*". Here the student picks up on the value of the avatar in generating an authentic learning experience based on their future profession. One student focused on what the avatar wears, since it is the uniform worn in real life: "*I liked the t-shirts. That was really cute*". The danger of this comment is that it may be seen to trivialise this aspect of the learning, but it is notable that this student felt it was important that the avatar wore the same uniform as the students are required to in their placements.

The gaming format is superior to other types of teaching mediums, such as PowerPoint, online quizzes, or Moodle files, since they do not use an animated pedagogical agent, an avatar, to help the student project themselves into the game. Without an avatar, the student is not assisted in practising to be a professional, nor are they encouraged to envisage that future image for themselves. This further reinforces the translation of teaching into learning via the game space, and is certainly an aspect of the game that students responded to well. According to one student, "*it's a better simulation of a real work environment than just repeating drug names*", and it allows the student to "*imagine yourself in a real situation, more than just 'shooting the right target' sort of game*".

Explicit curriculum and game design is essential for adult learners, who need to clearly see the benefits of a games-based approach to learning (Whitton, 2009). This format is much more accessible than simulation options such as *Second Life*. Furthermore, if it is made into a mobile application, the game is more portable than a resource-intensive simulation. The game takes advantage of informal learning – one which is available at all times. It allows the resource to reach all students and give exposure when it is wanted. This is not possible with face-to-face teaching and in this way facilitated learning supersedes expert/teacher-centred learning based on a transmission approach to learning.

Serious game assessment design

We can understand how games support learning in tertiary contexts by the manner in which they interact with other elements of the curriculum. Whitton strongly believes in the use of constructivism as a framework for designing game-based learning activities and integrating them into a curriculum:

"...educational games for students in higher education need to be thoughtfully designed, with sound pedagogical principles at their heart, have very specific and clearly communicated learning outcomes, and obvious benefits over other ways of learning" (Whitton, 2009:41).

An excellent theoretical framework for implementing constructivism in the higher education context is Biggs' notion of constructive alignment, which involves *"maximum consistency throughout the system"* (2003:64). Essentially, constructive alignment means identifying specific intended learning outcomes for the course or unit, and then carefully designing teaching and learning activities and assessment to be aligned with these intended outcomes. The students become *"'entrapped' in this web of consistency, optimising the likelihood that they will engage the appropriate learning activities"* (Biggs, 2003:64).

In the context of games-based learning, this is something akin to Squire's (2002) call for *"endogenous design"*, *"where the academic content is seamlessly integrated with gaming mechanics"*, or Whitton's (2009) preference for a user-centred design in educational games. This explicit attention to outcomes can be used within an evidence-centred design framework to develop the *"epistemic frames"* especially required for professional practice (Shaffer *et al.*, 2011). In this context, it becomes essential that we pay specific attention to *"what students do"* (Biggs, 2003). For nursing students, the curriculum is designed in the context of professional practice, and especially the requirements established by professional accreditation bodies.

The course aims of the Flinders University Bachelor of Nursing degree respond to the requirements of the Australian Nursing and Midwifery Council's National Competency Standards for the Registered Nurse (ANMC, 2006). These standards contain numerous references to communication skills required for the provision of care, emphasising context, sensitivity to the needs of individuals and groups, and the need for written and oral communication skills. In particular, Section 10.3 requires that a candidate *"demonstrates the necessary communication skills to manage avoidance, confusion and confrontation"* (ANMC, 2006:13) and it is clear that the skills of listening to a medication name and selecting it from a range of options fall into this category. Considering that good automated vocabulary knowledge forms the foundations for high-level communication, the game is internally consistent with the objectives of the nursing

curriculum. Furthermore, these skills requirements also fit into institutional-wide graduate attributes frameworks.

As well as emphasising outcomes orientation, constructive alignment eschews expert models and teacher-centred approaches to learning. Biggs argues that it is a *"teacher's job to organise the teaching/learning context so that all students are more likely to use the higher order learning process which 'academic' students use spontaneously"* (2003:57). Teachers thus need to focus less on teaching as such and more on facilitating learning. This is precisely the function of *Medicina*.

Biggs' focus on active learning and genuine student engagement in the learning environment echoes Whitton's (2009) call for student engagement, rather than simply motivation, through games-based learning. This is part of the reason why a game was a good solution to the problem of making the learning activity more meaningful. The game uses an active teaching method which requires student engagement, rather than a passive teaching method where content is transmitted to the student from an expert source. The game also offers problem-based learning which requires the student "*to question, to speculate, to generate solutions*" that characterises higher order cognitive activities (Biggs, 2003:58). Furthermore, since the game is mostly a self-controlled teaching/learning activity that involves discipline-specific language skills, content study, and the development of metacognitive skills, it elicits learning in the form of basic self-management, information handling, independence and self-monitoring (Biggs, 2003:68). Through this, it can support the crucial processes of self-regulated learning (Zimmerman, 1990).

Once a learning activity has an appropriate focus on outcomes, it is essential to design assessment activities that are also aligned with the entire system. Since *Medicina* is not part of the formal curriculum, this requirement is not as acute. Indeed, students highly value this reduced-stakes context: one student felt relief from playing the game because it allowed them to be "*familiar with medicine names which I've hardly had the chance to listen to them. Because it was a panic to listen to one of them in lectures and tutorials*". Another stated that "*It's prepared in a multimedia flash game which could get me familiar with medication names more easily. If you ask me to take a test, I panic*". Nonetheless, feedback mechanisms are essential to drive student learning and give cues as to current progress.

Medicina does give feedback, but in a non-threatening manner. Assessment in games-based learning is a particularly embryonic area

of study and practice, as it is in all e-learning environments (Crisp, 2007; Whitton, 2009). In the context of evidence-centred design, assessment is essentially for gathering information about student achievement in particular domains; the system can then respond appropriately to generate an automatised feedback/learning loop (Shute *et al.*, 2009; Shaffer *et al.*, 2011). This uses technology as a tool to facilitate what we already know to be an effective assessment strategy. Therefore, although *Medicina* does not have any formal, summative assessment built into it, the ongoing, formative assessment is essential to the facilitation of student learning.

Medicina gives timely feedback to maximise learning opportunities in a type of "*stealth learning*" (Shute *et al.*, 2009). The method of giving feedback outlined in the introduction in the game is one that uses the avatar and supports immersion experiences, but it does not disrupt the gaming experience. Thus, the student receives both verbal and non-verbal feedback in response to their student's actions. In *Medicina*, the curtain closes, thus visually finishing the incident, and a new round begins. The feedback cycle is quick, because the aim is to create a game that sets a series of short-term clearly-defined achievable challenges. This kind of feedback promotes automaticity, due to its speed and repetition. However, in terms of projected identity, the student-player is given visual feedback, albeit exaggerated, of the effect of a wrong choice in a clinical setting. For example, students reported that they didn't want to see their character cry, and it motivated them to try harder. A student mentions that "*you can feel what can happen when you go wrong with medicines*".

The type of assessment found in *Medicina* could also be referred to as ipsative assessment, measurement against a personal best, which is likely to be more motivational (Hughes, 2011). The students measure their own ability against themselves and each other as learners, and their scores are highly motivating: "*It's like playing a game. I want a higher score. Not worried about medicine names any more*", "*to check not only my score but also others' – it motivated me to challenge higher score*", and "*It made me want to learn, sometimes a very long time and get a high score*". A particular comment summarises the motivational experience of ipsative scores: "*the score is very motivating. When you get a lower score than before, you have to go back and get a higher score. Sometimes I tried over ten times to get a higher score. You get addicted in a way*". This kind of addiction to learning is certainly a clear distinction from the pathologised addiction

to games so often presented in the media, and perhaps can fulfil Gee's call for more compelling forms of formal education (2007a).

Conclusion

Ultimately, *Medicina* allows iterative learning cycles in a safe environment which partially mimics the clinical context and prepares a player for a future role as a nurse in a hospital ward. Student's own voices express the effectiveness of the game as a learning environment which enables iterative exposure to spoken and written clinical language. In particular, students can learn in a safe, comfortable environment where they can test their listening and reading skills with real, but reduced, consequences.

Medicina can be made available to other universities for international nursing students, and future plans include developing it as an application for mobile devices. It is also a part of a suite of language learning games for international nursing students, and it overall approach is applicable to a variety of disciplines and contexts. In particular, it uses a combination of game design, curriculum design and language learning approaches. We know this works because students report very high levels of satisfaction and early quantitative repeat-measures data, soon to be published, reveals promising results.

Medicina is a carefully designed learning activity based on both sound educational and language learning theory. It has wider influence in the curriculum by integrating work-ready communication skills and improving students' motivation to engage in wider coursework. This is done by simulating an authentic professional context and giving students an avatar which they can playfully engage with, and develop a projective identity which prepares them for the development of a professional identity. Not only does it facilitate task-focused, iterative learning cycles, it engages students through embedded, formative assessment design which motivates students to learn while giving them an ongoing benchmark against which to improve. All these elements enable a shift from teaching to learning by using the language of the profession and developing professional identities.

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