Investigating the Digital Literacy Needs of Healthcare Students: Using Mobile Tablet Devices for the Assessment of Student-nurse Competency in Clinical Practice

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Abstract. This case study investigates the digital attitudes, skills and development needs of nursing students when using mobile tablet devices to assess student-nurse competencies in clinical practice. Participants have been asked to complete a bespoke skills-based digital competence self-assessment questionnaire based on the EU DIGCOMP framework; this enabled a baseline for both individual and group. The individual characteristics of students were further explored through comments in their reflective diaries results show a complex, highly-individual profile for each student while the group exhibits common characteristics. Further work is proposed to investigate intricacies on how students perceive and use technologies in education and daily lives.

Keywords: digital competence, digital literacy, EU DIGCOMP framework, mobile devices, competency assessment

1 Introduction

This research is framed within the boundaries of a learning, teaching and assessment project which pilots the use of tablet devices and an application-based mobile electronic assessment portfolio. This assessed the practice competence of student-nurses. The project allowed for the rapid identification of students at risk of failure and facilitated early intervention. Academic practice was further enhanced by preventing potential falsification of competence sign-off from mentors, facilitating improved engagement practice and offering ecological and economic benefits in the form of saving paper and printing costs. Students were issued with a tablet device to own and use in their academic, personal and professional lives.

The digital literacy work is part of a wider action research project that has identified and validated the suitability of an appropriate digital competence framework through a qualitative analysis of the views of students and staff [1], developed self-assessment tools for quantitative assessing and mapping of their digital competences [2], and documented the views of students about the delivery of digital-literacy skills embedded within the curriculum delivery by utilisation of technology-enhanced activities designed along Dalziel's [3] Learning Design principles.

2 Methodology

Participants completed a bespoke skills-based online digital competence self-assessment questionnaire that allowed base-lining of the digital-literacy competence level of the group. This questionnaire toolkit development was based on the EU DIGCOMP framework [4] and included 21 questions organised into 5 themes.

Table 1 - DIGCOMP Framework Competence Areas

DIGCOMP Framework Digital Competence Areas	
1. Information	4. Safety
1.1 - Browsing, searching and filtering information	4.1 - Protecting devices
1.2 - Evaluating information	4.2 - Protecting personal data
1.3 - Storing and retrieving information	4.3 - Protecting health
	4.4 - Protecting the environment
2. Communication	5. Problem solving
2.1 - Interacting through technologies	5.1 - Solving technical problems
2.2 - Sharing information and content	5.2 - Identifying needs and technological responses
2.3 - Engaging in online citizenship	5.3 - Innovating and creatively using technology
2.4 - Collaborating through digital channels	5.4 - Identification of digital competence gaps
2.5 - Netiquette	
2.6 - Managing digital identity	
3. Content creation	
3.1 - Developing content	
3.2 - Integrating and re-elaborating	
3.3 - Copyright and licences	
3.4 - Programming	

The questionnaire toolkit requires the participants to self-assess their digital competences by selecting the most appropriate scenario to their perceived skill set. Evangelinos and Holley [1] found that the student population has diverse digital skills, attitudes towards technology and prior experiences. Students were asked to think whether they possessed the skills and attitudes to complete the proposed activities regardless of having actually completed similar activities in the past. The questionnaire presented the participants with 5 competence areas expressed as groups of questions. Each question presented the participants with 4 examples of possible hypothetical role-play technology-use scenarios and asked them to select the answer that best matched their skills. The scenarios were progressively becoming more complex and were designed to represent different digital literacy profiles ranging from lack of skills to elementary, intermediate and advanced. The scenarios were customised to present the students with authentic situations relevant to their academic

experiences. An example of the scenario-based questions can be seen in Figure 1 - Question 2.4 of the DIGCOMP Self-assessment Toolkit below.

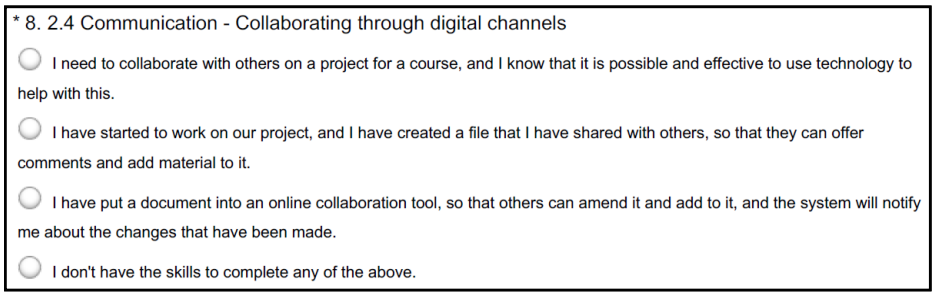

Figure 1 - Question 2.4 of the DIGCOMP Self-assessment Toolkit

24 out of 30 students completed the questionnaire (return rate of 80%). The results were exported and analysed by using the Microsoft Excel 2010 spreadsheet software and produced a wealth of data that can be analysed in various ways. For the purposes of this paper the group characteristics of the students will be examined. A wealth of quantitative indicators of student digital-behaviour was revealed. The questions for each competence group were averaged together to give a more reliable single number index (here defined as #eudc_competencearea). For this group the '#eudc_' indices are as per Figure 2 - #eudc_ Group Indices below. The group digital-literacy map presents the average group digital literacy index as a composite index that is sampled (averaged) across a number of competence-specific scenarios. Please note the existence of different numbers of scenarios in each area (3-6-4-4-4). For example, the #eudc_information index is a composed average of three information-literacy sub-questions; the communication area is expressed as six sub-questions and content - creation, safety and problem solving are represented by four questions each.

Students were also invited to complete short reflective diaries to reflect and record their technology-use experiences in their private, academic and work lives, and to report their perceptions of digital literacy, comment on the views concerning the acquisition of skills, areas for further development and provide feedback suggestions on how the university can facilitate the enhancement of their digital skills. 15 students out of 30 completed the reflective diaries corresponding to a significant percentage (50%) of the participants. The analysis was conducted by using QSR NVivo 10 software and coding the reflective diaries into themes following the Glaser and Strauss' [5] Grounded Theory approach, as well as the coding recommendations by Miles and Huberman [6] and Guest et al [7].

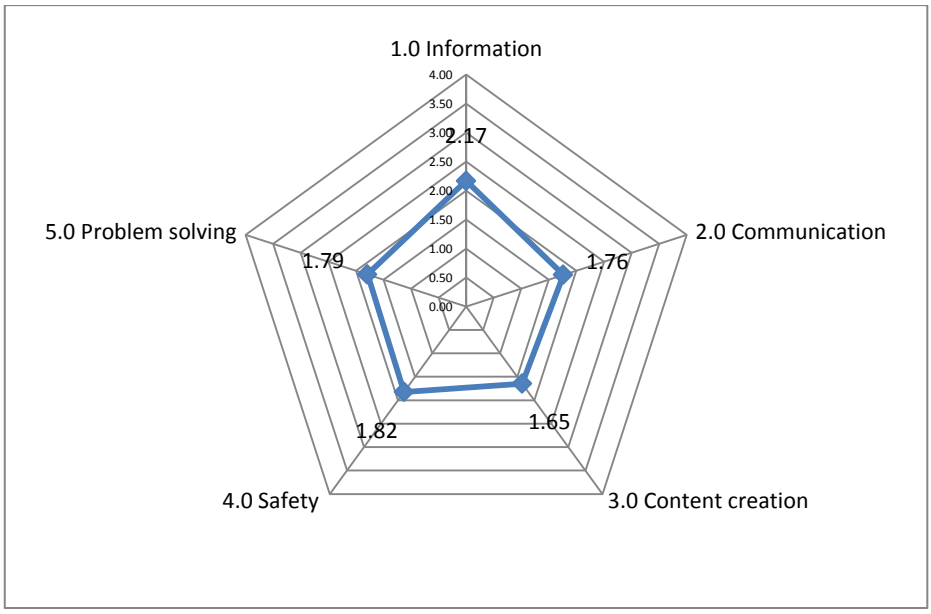

Figure 2 - #eudc_ Group Indices

Explanations of pertinent ethical considerations, such as confidentiality of collected data, anonymity of the subjects, ownership of the data, and results of the study were provided and the participants were given the choice of participating anonymously, withdrawing without penalties or even dictating conditions on the use of data. Informed consent was obtained in writing according to the research protocol governed by the university's ethical procedures.

3 Results

The 21 questions (organised in the 5 competence areas) define 5 key metrics: a) Information b) Communication c) Content Creation d) Safety and Privacy and e) Problem Solving (see: Figure 2). For example, the #eudc_Information index with an average of (2.17) points (on a scale from 0-4 where 0 means no skills, 1 is basic, 2 intermediate and 3 or over is considered as advanced) denotes that on average students have just over an intermediate self-declared competency in the information competence area. The group was least confident about their self-declared skills in the content creation #eudc_ContentCreation competence area with an average score of (1.65) or basic competence. The average values can be used to baseline where the general group competency lies but when combined with the digital literacy group distribution it gives a two-dimensional perspective on the qualities of digital-literacy, group-dynamics and distributions. As evidenced below in Figure 3 - Digital Literacy Group Distribution – the digital literacy capabilities of the group varied; information, communication and problem solving were closer to the upper limit of basic

competence trending towards intermediate competency, while safety, privacy and content creation were closer to basic competency. It is interesting to note that seven individuals were rated at both extremes.

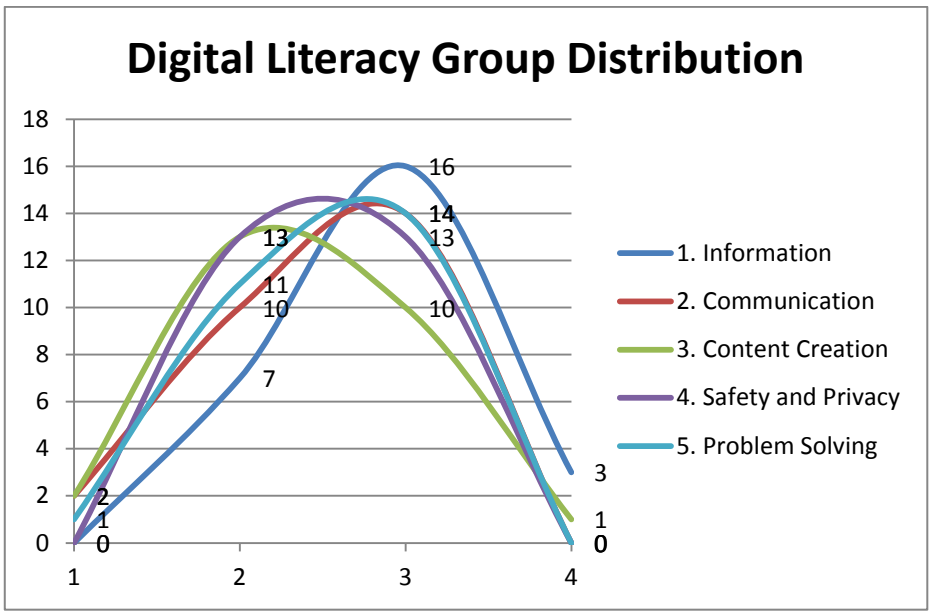

Figure 3 - Digital Literacy Group Distribution

The 21 participants of the questionnaire were all female, 16 (76%) between 18-25 years of age, 3 (14%) between 26-35 years of age and 2 (10%) between 46-55 years of age. When asked how they are informed about new digital technologies they reported that they learn about technologies primarily from friends and family (21), traditional media (16), online digital sources (14), library services (3) and part of their course at university (4).

The participants were also asked to identify their technology use, and to establish the utilisation of technology and the different types of technology that should be of concern in a student's private, academic and work life. Figure 4 - Technology Use shows that a laptop computer (20) is still the predominant technology in formal learning, with desktop computers (16) and tablets (15) being closely second and mobile telephone equipment being used to a limited extend (10). In their private lives, students seem to use a much larger variety of technologies where tablets (20), smart phones (20) and laptops (19) are frequently used. In research laptops (19), tablets (17) and smart phones (16) are often used.

Twelve weeks after the students were given the tablets and completed the questionnaire they were asked to consider their digital literacy learning and development cycle and critically document their experiences on using and learning about and with mobile tablet digital-technologies in their a) private, b) academic and c) work lives by using self-reflect on their experiences.

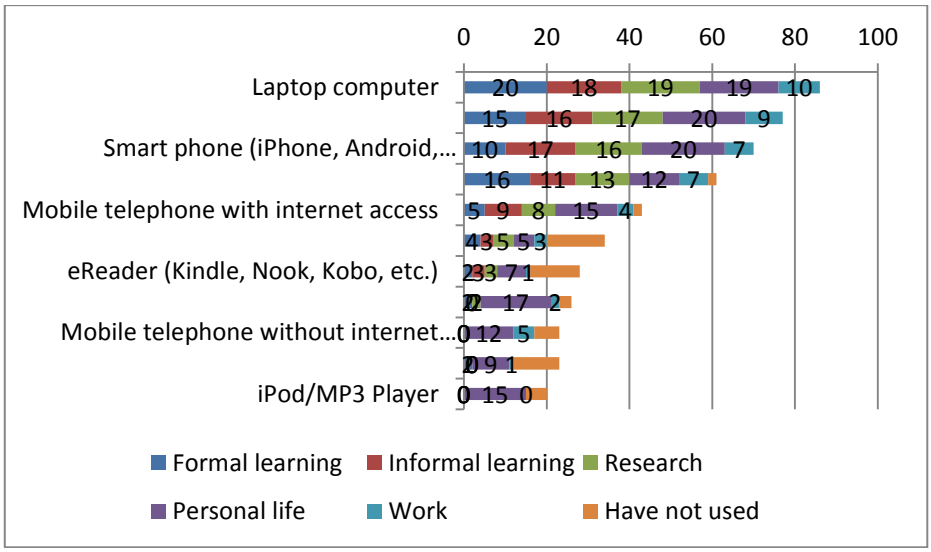

Figure 4 - Technology Use

The initial analysis of the reflective diaries showed that in private life students are concerned with communication (11), usability (11), and experience (9). Social networking and communicating with friends and family when travelling or being on the move was one of the most appreciated affordances of technology. Students also use mobile digital technologies to access systems for carrying out everyday activities including communication and interacting with the university. They expect a seamless experience when accessing systems from their smart phones or tablets and expect to be supported when things do not work properly.

Table 2 - Diary Analysis Top Three Categories

Private		Academic		Work	
Communication	11	Experience	12	Experience	10
Usability	11	Usage	11	Communication	8
Experience	9	Information	8	Organisation	8

In academic life they are concerned with experience (12), usage (11) and information (8). Most participants admitted that technology engagement for higher education study is a necessity and that they generally feel comfortable in using more than one type of technology. Tablet and smart phone use was widespread, and although some individuals admitted they were lacking the necessary skills for making effective use, they were willing to acquire the missing competences and skills. The main usage-patterns included the use of subject-specific apps to acquire knowledge, revising the PowerPoint handouts from the VLE, using single sign-on to access the university infrastructure, using tablet apps for note taking, access university information and timetabling and e-submission of the assessment nurse competencies. From an information perspective mobile technologies are used for exam revisions,

information retrieval online that includes books, journals and websites enabling the users' studies. Eight students emphasised the value of using tablet devices within lectures to broaden their understanding, check facts and definitions or review and focus their study on difficult concepts.

In work life experience (10), communication (8), and organisation (8) are the top three categories of concern. There is consensus that mobile technologies are becoming increasingly pervasive in all aspects of everyday life including work and usage in the workplace. Participants generally felt comfortable with using the tablet devices for work and they drew examples on how these tablets were successfully used for data entry in restaurants. The participants also reported that similar applications of technology could potentially change their work attitudes. From a communication perspective they generally found it useful to have access to technology when in clinical placements as they often needed to access information and/or communicate with the university and their tutors. Examples of organisational implications of technology-use in the workplace include the use of mobile devices, applications such as the calendar, reminders which are used to manage diaries, and the setting of work-related reminders and notes. One participant reflected, '… *for patients for their doctors' visits, and their families' visits*', while another reported the use of social media as tools for publishing and managing rotas.

4 Discussion and Conclusions

This action research multi-method approach gathered two sets of data: a) the digital literacy quantitative indicators #eudc_ and demographics and technology-use distributions and b) the reflective diaries where students self-reflected on their digital-literacy affordances.

At a group level the quantitative metrics seemed to accurately measure a snap-shot of the digital competences, skills and attitudes of the DIGCOMP framework. Students as a group seemed to be reasonably comfortable in using technologies to communicate, learn, research and generally engage with technologies in a number of ways as individuals; on average they showed a command of above-basic digital competences located at the borderline of intermediate. This type of analysis is of interest for the optimisation of teaching. Although the individual data tells a different story, it must be stressed that the purpose of this research was the consideration of group dynamics.

Interestingly, the frequency distribution indicated normal distribution of individual digital-competence. The 7 individual 'outliers' were students who lacked digital skills and students who had expert profiles. This method offers possibilities for early identification of students with advanced, and indeed, lacking in, essential digital skills. This offers potential in the classroom for early intervention in the latter case; and further development and utilisation of those with existing advanced skills. For teaching, it may be possible to construct more balanced groups, and thus scaffold informal learning of digital skills by considering Vygotskyian [8] ideas of 'the more capable peer'. From a technology-use perspective student self-reporting of pervasive use of laptops, tablets and their private and work lives was significant. At the same

time the group seemed less comfortable in the areas of content creation, communication and problem solving, and more competent in information management and safety.

The research diaries collected for documenting the intricate details of the individual competences, skills and attitudes allowed for the appreciation of the main areas of focus of each student. It seems that students face academic life as a part of their 'everyday' life, and practice placements as their 'workplace'. However, these distinctions are arbitrary as most students reflected from their individual circumstances and experiences. What matters to them is the way they individually use technology to achieve their own aims in their own private, academic and work lives, and this offers insights for the academics seeking to support their learning.

This paper established metrics for defining and measuring digital literacies in higher education based on the development of the #eudc_competences as it is defined in the DIGCOMP framework. The metrics offer robust descriptors of digital competence and, when combined with an analysis of technology-use and diary analysis suggest types of technologies with preferred private, workplace and academic contexts for learning.

Further work will include focus groups to investigate further students' views and practices using the mobile tablet devices; but findings thus far already have the potential for re-conceptualising the curricula for the forthcoming intake of nursing students.

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