Use of digital applications in the medicament calculation education for nursing

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Objective. To evaluate the influence of the use of digital applications in medicament calculation education for nursing students. **Methods.** An experimental study was developed with a sample of 100 nursing students, who were divided randomly into two groups (use of the Calculation Medicines – *CalcMed* application – available free on the Internet, $n=50$) and control (conventional method of the calculator use and pre-math skills, $n=50$). Both groups were assessed before and after the application of the teaching strategy through a test with ten specific questions of medicament calculations. **Results.** The study group showed a mean score of 8.14 versus an average of 5.02 in the control group. The average time of test execution was faster in the study group compared to the control group (15.7 versus 38.9 minutes). **Conclusion.** The strategy of using this application positively influences learning and enables greater security in the implementation of medicament calculations.

Key words: educational technology; nursing informatics; teaching materials; education, nursing.

Utilización de aplicativos digitales en la enseñanza del cálculo de medicamentos para enfermería

Objetivo. Evaluar la influencia del uso de aplicativos digitales en la enseñanza del cálculo de medicamentos en estudiantes de enfermería. **Métodos.** Se desarrolló un estudio experimental con una muestra de 100 estudiantes de enfermería del Municipio de Fortaleza CE, Brasil, asignados en forma aleatoria a los grupos de estudio (utilización del aplicativo Cálculo de Medicación –*CalcMed*- disponible gratuitamente en

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Internet, $n=50$) y de control (método convencional con uso da calculadora y habilidades matemáticas previas, $n=50$). Ambos grupos se evaluaron antes y después de la aplicación de la estratégia de enseñanza con un examen de diez preguntas específicas con **cálculos de medicación**. **Resultados.** El grupo de estudio presentó una media de aciertos de 8.14 versus media de 5.02 en el grupo control. El tiempo de ejecución del examen fue **más rápido** en el grupo de estudio comparado con el del grupo control (15.7 minutos versus 38.9). **Conclusión**. La estrategia en cuanto a la utilización este aplicativo influencia positivamente el aprendizaje y posibilita una mayor seguridad en la ejecución de los **cálculos de medicamentos.**

Palabras clave: tecnología educacional; informática aplicada a la enfermería; materiales de enseñanza; educación en enfermería.

Utilização de aplicativos digitais no ensino do cálculo de medicamentos para enfermagem

Objetivo. Avaliar a influência do uso de aplicativos digitais no ensino do cálculo de medicamentos em estudantes de enfermagem. **Métodos**. Se desenvolveu um estudo experimental com uma amostra de 100 estudantes de enfermagem do Município de Fortaleza - CE, Brasil, os quais foram designados em forma aleatória aos grupos de estudo (utilização do aplicativo Cálculo de Medicação –CalcMed- disponível gratuitamente na Internet, $n=50$) y de controle (método convencional com uso da calculadora e habilidades matemáticas prévias, $n=50$). Ambos grupos foram avaliados antes e depois da aplicação da estratégia de ensino com uma prova de dez perguntas específicas com cálculos de medicação. **Resultados.** O grupo de estudo apresentou uma média de acertos de 8.14 versus media de 5.02 no grupo controle. O tempo de execução da prova foi mais rápido no grupo de e0studo comparado com o do grupo controle (15.7 minutos versus 38.9). **Conclusão**. A estratégia de utilizar este aplicativo influencia positivamente a aprendizagem e possibilita uma maior segurança na execução dos cálculos de medicamentos.

Palavras chave: tecnologia educacional; informática em enfermagem; materiais de ensino; educação em enfermagem.

Introduction

The teaching-learning process has undergone important changes in recent years due to the decentralization of the unique knowledge of the teacher, enhancing the empowerment of the student and the development and use of more interactive and dynamic learning resources, especially technological innovations.[1] In the midst of these resources, digital technologies are emphasized, which are tools seeking among other purposes, to facilitate the implementation of human tasks, minimizing the possibility of errors and promote the safety of the various systems. Its applicability has been very intense as aid resource in the teaching-learning process because it is known that connectivity and digital language are part of contemporary education.[2]

The skills related to the use of technology delineate a new model for teaching at the University. The resources offered by computers, the Internet and other communication networks highlight the need to establish links between the disciplines and to everyday reality.[1] Notably, the current information is richer in form and more diverse in content than those existing in traditional teaching. Thus, the teacher can choose diverse resources, depending on the purpose, content and student characteristics.[3,4] In this regard, several studies have shown that the application of technological resources, such as *Moodle*, applications, social networks, forums and Virtual Learning Environments, provide the acquisition of knowledge and cognitive skills to perform nursing procedures, increasing security and self-confidence for their achievement by students.[5,6]

In this study, the technology came in using a *Software* developed to be installed in a mobile electronic device such as mobile phones,

Smartphones, and *Tablets*. This resource was chosen because it is a possible computational tool to be run on mobile phones, which is one of the most democratic means of access to digital inclusion today. Therefore, the idealization of this study was originated from the observation of nursing teachers at a private Higher Education Institution about the difficulties that the students had to carry out the mathematical calculations about the preparation and dilution subject of medicament, since this task requires simple mathematical knowledge as basic operations, rule of three and logical reasoning. These difficulties affected the learning achievement and formed in a stress factor for the beginning of practical activities in hospitals.

Faced with this context, the question is: Does the use of mobile applications for nursing students positively influence the learning of medicament calculations? This study is justified because of the use of information technologies in health should be increasingly incorporated into daily nursing education, to make it a more attractive and less stressful process and provide a safer nursing assistance, reducing potential human error. There exists also the effectiveness of technology internalization in education based on the Theory of Meaningful Learning exalting in its concept, the premise that new knowledge must relate to non-arbitrary and substantive way to the cognitive structure of the individual learning, i.e., otherwise, the new contents must have significant association with prior knowledge of the student, and at the same time, motivating methods must be used in subsequent practice.[7] This study aimed to evaluate the influence of the use of digital applications in learning of nursing students about medicament calculation.

Methods

This is an experimental study, conducted between February and May 2013 in a private Higher Education institution in the city of Fortaleza-CE, Brazil, on Systematization Caring I discipline. That discipline has theoretical and practical approach,

it is offered in the second semester of the Nursing on-site undergraduate course, where the research took place, and has, on its menu, the acquisition of basic knowledge and skills related to the nursing process, measurement and assessment of vital signs, and, finally, general notions of calculation and medicament administration, which made it suitable for the application of this research. At the time that this research was conducted, there were three groups attending the course, each with 50 students, comprising, therefore, a population of 150 students. The probabilistic sample was calculated based on the calculation of finite populations considering sampling error of 5% and a confidence level of 95%, which is likely to be more efficient with the use of the application, resulting in 100 students. Thus, the participants were recruited according to the following inclusion criteria: being regularly enrolled in the Systematization Caring I discipline in the locus of research institution; having a gadget of *Android* type compatible with the application language and to have skills with the use of simple technological resources. Those who did not participate in medicament calculation classes were excluded.

After the selection, the sample was divided into two subgroups, for a random drawing of the intervention and the control group and the intervention group was composed of 50 students who would use the *CalcMed* application, and the control group of 50 who would use the conventional method (calculator use and previous math skills). Two teachers of the discipline participated as researchers/mediators, and they will be identified as Professor A and Professor B. *CalcMed* application is available for free *download* in *Google Play* web store, and was chosen for use in this research, because it is an application with attractive interface, easy usability, and usability even in *offline* mode. It has commands for the basic operation of medicament calculations, such as drip, flow, and solutions transformation.

The intervention was implemented as follows: Professor A enabled the research participants about using the application "Medication

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Calculation" and about the traditional method of resolving problem situations involving medicament calculation for all students of both groups. At the end of Systematization Caring I discipline, of the Nursing course, the students of both groups were asked to respond to a test with ten specific questions about medication calculations (dilution, serum drip, solutions reconstitution, processing plants measure) in the maximum time of sixty minutes, where the test with green marking was the intervention group, and the control group was red. The following items were measured: a number of errors, a number of correct answers and test time resolution. The collected data were analyzed by Professor B that did not participate in the initial stages of the study and did not know who where the intervention and control groups to ensure fairness in the evaluation of results. Finally, the data were organized in tables and analyzed with the help of descriptive statistics with an average presentation, mode of both groups, and confidence intervals. Throughout the search, the ethical principles of human research under Brazilian law[8] were followed, and all students who agreed to participate signed the Consent Form after being informed about the research

objectives. The study was approved by the Ceará Federal University Ethics Committee with protocol 191/11, as part of a set of interventions to reduce the stress level of nursing students when they experience the hospital practice.

Results

The following is the presentation of the results collected from the application of an educational and traditional technique for medicament calculation by nursing students. The participants profile concerning gender was composed predominantly by female (40 in the intervention group and 42 in the control group) while males comprised a lower sample rate (10 in the intervention group and 8 in the control group). As showed in Table 1, it is clear that the average age is 22.4 and 19.9 years old for the intervention and control groups, respectively. When evaluating the variable mode hits, error average, and average test run, it is clear that there was a significantly better use in individuals who used the application to perform the calculations with a percentage of success in the range of 80% of the proposed items.

Table 1. Distribution of the results of the intervention and control groups regarding mode hits, an average of age and errors, and test execution time. Fortaleza-Ce, 2013

Variables	Intervention Group (n=50)	Control Group (n=50)
Age Average	22.4 ±2 years	19.9 ±3.2 years
Mode Hits	9	5
Error Average	1.83 ±0.5	4.98 ±1.0
Average execution time	15.7 ±21min	38.9 ±4.3min

In Table 2 we note that there was a mean score of 8.14 ± 1.67 points for the intervention group and only 5.02 ± 3.21 for the control group, showing, therefore, more efficient with the use of the application. The measurement of successes in the test showed that the lower limits of the intervention group and superior of the control group were very close, which confirms

that the use of the application generates higher probability of correct answers for the medicament calculation. As seen in Table 2, is notorious an assertive improvement with the application usage compared to the use of calculators and previous mathematical knowledge, which allows to improve the technique and minimize considerable errors for practice.

Table 2. Distribution of the results of the case and control groups related to the hits average and confidence interval. Fortaleza-Ce, 2013

	Intervention Group (n=50)	Control Group (n=50)
Hit average	8.14 ±1.67	5.02 ±3.21
Minimum hit average	6.4	1.8
Maximum hit average	9.8	8.2

Discussion

This research coincides with other studies that show that this is the age average of students in Brazilian universities, and in particular in this study the age range also converges with the data on the profile of mobile technology users in the country, where the majority it is young adults. Research with public academics and similar study proposals also found more frequently in women with age range between 18 and 30 years old.[9-11] In this study, it was observed that the use of the application presented satisfactory results in student learning, which corroborates the literature of the area, where there is evidence that this type of education for the development of skills for the nursing student is recommended, as it allows easy access to the mobile phone connected to the Internet, and can be accessed in the practical field of activity for theoretical content query, solve problems and make theoretical and practical associations.[9] The research showed that the incorporation of Information and Communication Technologies in education emerges the need to rethink the paradigms of teaching practice and the role of the teacher/pupil in teaching/learning.[12] A dialogue between traditional education and digital tools is also manifested in a different manner when compared to the developed countries to developing ones, it is known that in the latter case there are limiting factors for the implementation of this educational proposal, including: resource scarcity financial, lack of qualified teachers in developing and using digital tools, and lack adequate government policies.[13]

The research showed that the incorporation of Information and Communication Technologies in education emerges the need to rethink the paradigms of teaching practice and the role of the teacher/pupil in teaching/learning activities.[12] The interlocution between traditional education and digital tools is also manifested in a different manner when compared to the developed countries to developing ones because it is known that in the latter case there are limiting factors for the implementation of this educational proposal, including: financial resource scarcity, lack of qualified teachers in developing and using digital tools, and lack of adequate government policies.[13] A study performed in Ethiopia with 1 096 of health students pointed out that one of the major barriers to the implementation of computer technologies in higher education has little skill and scarce knowledge that students have to hold a dialogue between these tools and learning curriculum content. Nevertheless, it raised the fact that deficient knowledge about information and communication technologies can generate greater resistance to using these resources to enhance learning.[13] Concerning the great advances in information and communication technologies, the information technology has become an essential tool for the development of nursing. The technology through computer resources supports nurses in the practice of the profession in its various areas: education, assistance, research, and management. [14]

Increasing the effectiveness of technology in nursing education, a study added that the students evaluated the use of educational technology objects qualitatively, giving a high degree of satisfaction and highlighting the possibility of collaborative development. However, they stressed that the teacher's physical absence is a limiting factor for learning.[15] The teacher is, therefore, an essential channel between technology and

the student, he discusses, elucidates and provides theoretical and practical knowledge, coming so easily to interactivity. Considering the dynamic and usability nature of the application in practice of the medication calculation, it can be concluded that its use has caused students save an average of 23 minutes to resolve issues related to medicament calculations with a very low error average. Regarding the time variable for resolution of the applied test questions, a similar factor was noticed in a research that has developed an application for *Smartphone* about staff dimensioning in Intensive Care Units, where it was concluded that this resource reduced the working time devoted to indirect patient care, i.e., away from the head of the bed, thus enabling greater availability of professional to provide direct assistance to the customer.[16]

According to literature, the technology can be considered the seizure and the application of a set of knowledge and assumptions that enable individuals to think, reflect, act, making it the subject of their existence process. In turn, the creation of technologies arising from the act of caring is based on technical and scientific knowledge, observation of daily life and concern for the well-being of both the caregiver as the subject of care.[1] Thus, this application involves the construction of a tangible artifact, aimed at improving health based on scientific knowledge. The use of this technology serves as a complement to the educational methodology already applied, forcing the teacher to keep constantly updated over the present.

The technology as a process configures an additional resource, essential and derived from product technology. It aims to ameliorate its shortcomings, by means of groups which humanize; the skills or training that reduce the risks to which the individual, community or professional would be exposed, and enables the use, maintenance and evaluation of the designed product.[17] The presence of this technological apparatus in the classroom does not guarantee changes in the way of teaching and learning. The technology should serve to enrich the educational environment, providing the construction of knowledge through active participation, critical and creative by students and teachers. To develop the teaching-learning process, using digital technologies, it is crucial that teachers and students are engaged, understanding them as subjects. In this sense, teachers need to worry about the continuous renewal of the technical and/or teaching modalities and prepare structured strategies for not occur under-use/overestimates of digital resources.

It is perceived that nursing, in the care of promoting science condition, should take over existing technologies to improve the quality of care because works of this nature contribute to the dissemination of new knowledge. The understanding of technology in health provides to professionals, support of their actions in the theoretical and methodological framework, enabling the application of the concept to its fullest.[12] Thus, it would be interesting to get increasingly targeted applications for health, to substantially improve the services and minimized human error. It is noted that the use of technology will always be linked to human care, where one will complement each other and does not be replaced.

Regarding technology and education, characterized by interactivity and non-linearity, defined as a web of knowledge and a networked education. The teacher must dominate the machine and take advantage of the potential of technology for the benefit of an education and a more creative, autonomous, collaborative and interactive learning, without the need to fear it.[6] The research warns that the nursing performance may be adversely affected if the information and communication technologies are improperly used.[18] By choosing to incorporate technology, it is imperative that educators have basic rules for good teaching practice and resource domain. The teaching experience in the creation and selection of technological tool can influence the student´s satisfaction in the learning process.[4]

Given the above it is possible to identify the benefit of the use of the application in the classroom because it optimizes the time of the

student and the teacher, makes the student has increased security in performing that particular calculation and prevents a greater number of errors in applying the calculation. The use of new technologies will improve the technical and scientific progress and makes nurses seek new resources to improve practice, reduces time to technical applications and results, establishes the patient's well-being and provides more security in the realization of care.

The conclusion of this research is that the application use by nursing students on medication calculation generates a satisfactory and positive impact on learning, and enables the execution of care with greater safety to patients and future professional. There is also in this way that this technology (application) can improve the acquisition of nursing students knowledge in a complementary manner to traditional education.

The technologies should be used by teachers and students in various ways, from building computerized databases, bibliographic material, applications, even those applied in different nursing activities, whether in teaching, research or professional practice. The study limitations include the fact of not having been performed quality criteria evaluating the application as the result of learning, such as how much time students need to learn the commands? Is it possible a group work? Does the interface allows the *feedback* with smart strategies and open to information with users' assistance and decisions? It is suggested, therefore, to evaluate these qualitative characteristics, and that new applications can be developed and incorporated into the education of other techniques and nursing procedures in an attempt to strengthen the teaching-learning process.

References

1. Okada A, Barros DMV. Ambientes Virtuais de Aprendizagem aberta: bases para uma nova tendência. Rev Digit Tecnol Cognitivas. 2010; 3:20-35.

2. Paiva VMO. Ambientes virtuais de aprendizagem: implicações epistemológicas. Educ. Rev. 2010; 26(3):353-70.

3. Castro MCN, Dell' Acqua MCQ, Corrente JE, Zornoff DCM, Arantes LF. Aplicativo informatizado com o nursingactivities score: instrumento para gerenciamento da assistência em unidade de terapia intensiva. Texto Contexto - Enferm. 2009; 18(3):577-85

4. Alvarez AG, Dal Sasso GTM. Virtual learning object for the simulated evaluation of acute pain in nursing students. Rev. Latino-Am Enfermagem. 2011; 19(2):229-37.

5. Telles-Filho PCP, Cassiani SHB. Creation and evaluation cycle of a distance module for nursing undergraduates, named "Medication admnistration". Rev. Latino-Am Enfermagem. 2008; 16(1):78-85.

6. Frota NM, Barros LM, Araújo TM, Caldini LN, Nascimento JC; Caetano JA. Construção de uma tecnologia educacional para o ensino de enfermagem sobre punção venosa periférica. Rev. Gaucha Enfem. 2013; 34(2):29-36.

7. Moreira MA, Mansini EFS. Aprendizagem significativa: a teoria de David Ausubel. 2nd ed. São Paulo: Centauro; 2011.

8. Resolução Nº 466 do Conselho Nacional de Saúde, de 12 de dezembro de 2012 (BR). Aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Diário Oficial da União. 13 jun. 2013

9. Galvão ECF, Püschel VAA. Aplicativo multimídia em plataforma móvel para o ensino da mensuração da pressão venosa central. Rev. Esc. Enferm. USP. 2012 ; 46(esp):107-15.

10. Cruz NS, Soares DKS, Bernardes A, Gabriel CS, Pereira MCA, Évora YDM. A competência técnica em informática de alunos de enfermagem. Rev Esc. Enferm. USP. 2011; 45(Sp):1595-9.

11. Costa PB, Prado C, Oliveira LFT, Peres HHC, Massarollo MCKB, Fernandes MFP, et al.. Digital fluency and the use of virtual environments: the characterization of nursing students. Rev. Esc. Enferm. USP. 2011; 45(Sp):1589-94.

12. Holanda VR, Pinheiro AKB, Fernandes AFC, Holanda ER, Souza MA, Santos SMJ. Análise da produção científica nacional sobre a utilização de tecnologias digitais na formação de enfermeiros. Rev. Eletr. Enf. 2013; 15(4):1068-77

13. Woreta SA, Kebede Y, Zegeye DT. Knowledge and utilization of information communication technology (ICT) amog health Science studentes at the university of Gondar, North Western Ethiopia. Med. Inform. Decis. Mak. 2013; 3:13-31.

14. Sanches LMP, Jensen R, Monteiro MI, Lopes MHBM. Informatics teaching in undergraduate nursing programs at Brazilian public institutions. Rev. Lat-Am Enfermagem. 2011 ; 19(6):1385-90.

15. Cogo ALP, Silveira DT, Pedro ENR, Tanaka RY, Catalan VM. Aprendizagem de sinais vitais utilizando objetos educacionais digitais: opinião de estudantes de enfermagem. Rev. Gaúcha Enferm. 2010; 31(3):435-41.

16. Catalan VM, Silveira DT, Neutzling AL, Martinato LHM, Borges GCM. Sistema NAS: NursingActivities Score em tecnologia móvel. Rev. Esc. Enferm. USP. 2011; 45(6):1419-26.

17. Aquino PS, Melo RP, Lopes MVO, Pinheiro AKB. Análise do conceito de tecnologia na enfermagem segundo o método evolucionário. Acta Paul. Enferm. 2010; 23(5):690-6.

18. Fujino Y, Kawamoto R. Effect of information and communication technology on nursing performance. Comput. Inform. Nurs. 2013; 31(5):244-50.