

..... EDITORES .....

PEDRO MEMBIELA, MARÍA ISABEL CEBREIROS Y MANUEL VIDAL

# PANORAMA ACTUAL DE LA ENSEÑANZA DE LAS CIENCIAS

**EE**  
Educación Editora

**Panorama actual  
de la enseñanza de las ciencias**

**Panorama atual  
do ensino de ciências**

Pedro Membiela, María Isabel Cebreiros y  
Manuel Vidal (editores)

**Educación Editora**

Edita Educación Editora

Roma 55, Barbadás 32930 Ourense

*email:* [educacion.editora@gmail.com](mailto:educacion.editora@gmail.com)

Imprime Educación Editora

ISBN: 978-84-15524-42-7

# Índice

- 1. Influencia de la religión en la ciencia: comprensión de estudiantes de bachillerato**  
Antonio García-Carmona, María del Mar Aragón-Méndez y José Antonio Acevedo-Díaz ..... 17
- 2. Comprensión de estudiantes de bachillerato sobre el papel de los objetivos de las investigaciones científicas**  
María del Mar Aragón-Méndez, José Antonio Acevedo-Díaz y Antonio García-Carmona ..... 23
- 3. Una experiencia práctica de educación para la salud en educación primaria**  
Marta Isabel Pablos Miguel y Ana M<sup>a</sup> Verde Romera ..... 29
- 4. Estudio de modelos didácticos y recursos utilizados por maestros en el aula de primaria**  
Vanessa Ortega-Quevedo y Cristina Gil Puente ..... 35
- 5. Los gráficos en los libros de texto de primaria**  
Gustavo R. Cañadas, Rebeca Guirado, Rocío Álvarez y Elena Molina ..... 41
- 6. La educación para la salud en la formación del profesorado de educación primaria**  
Ana M<sup>a</sup> Verde Romera y Marta Isabel Pablos Miguel ..... 47
- 7. Uso de MathCad en ingeniería química: diseño de reactores con reacciones en serie**  
Antonio Abad Cuadri, José Enrique Martín-Alfonso y Juan Urbano ..... 53
- 8. Los contextos PISA en la evaluación de matemáticas dentro de la educación primaria**  
Gustavo R. Cañadas, Rebeca Guirado, Rocío Álvarez y Elena Molina ..... 59

<b>9. La transposición didáctica respecto a la percepción de riesgo en la ESO: enfermedades de transmisión sexual y fenómenos sísmico-volcánicos. Ideas preliminares</b> Juan Ernesto Pérez Yepez, Cristian Felipe Díaz y Miguel Ángel Negrín Medina .....	65
<b>10. Avaliação da estratégia Dinâmica de Dominós no ensino de Genética</b> Raphael Severino Bonadio, Sabrina Guimarães Paiva e Maria de Nazaré Klautau Guimarães .....	71
<b>11. Percepção dos professores: diferentes olhares sobre a contribuição da avaliação nos processos de ensinar e aprender</b> Vicente Henrique de Oliveira Filho e Gilberto Tavares dos Santos .....	77
<b>12. Una propuesta lúdica de alfabetización científica en el ámbito de las ciudades</b> Miguel Quiroga Boveda y Benito Vázquez Dorrió .....	83
<b>13. Indo à sala de aula: ação envolvendo linguagem escrita e Matemática com professores em formação</b> Liliane Silva de Antiqueira e Celiane Costa Machado .....	89
<b>14. Una experiencia de aprendizaje basado en problemas en disoluciones en Química general</b> María Inés Aguado, Leila Magalí Sarkady, Mario Rolando Molina y Mariela Judith Llanes .....	95
<b>15. Desarrollo de la competencia “planificación” en la asignatura de Química impartida en la Escuela Politécnica Superior de la Universidad de A Coruña</b> M <sup>a</sup> Jesús Rodríguez-Guerreiro, Almudena Filgueira-Vizoso, Laura Castro-Santos, Luis Carral-Couce, José Ángel Fragueta-Formoso, José-Carlos Álvarez-Feal y José Troya-Calatayud .....	101

<b>16. Espaços de Educação não Formal e Educação em Ciências: Reflexões em Torno de Eventos e Ações na Região sul da Bahia</b> Danilo Almeida Souza, Raphaela Oliveira dos Santos, Christian Ricardo Silva Passos e Thiago Nascimento Barbosa .....	107
<b>17. A alfabetização tecnológica como ferramenta para o ensino da Estocástica</b> Alessandra de Abreu Corrêa e João Bernardes da Rocha Filho .....	113
<b>18. El libro de texto en las clases que planifican los futuros docentes de ciencias</b> Carla Inés Maturano y Claudia Alejandra Mazzitelli .....	119
<b>19. Docentes y ciencia recreativa</b> Alejandro Robles, Jordi Solbes y Óscar R. Lozano .....	125
<b>20. Relación entre las emociones y la capacidad para aprender contenidos relacionados con la materia, su estructura y composición en alumnos de educación secundaria obligatoria</b> M <sup>a</sup> Antonia Dávila Acedo, Ana Belén Borrachero Cortés, Florentina Cañada Cañada, Jesús Sánchez Martín y Diego Airado-Rodríguez .....	131
<b>21. Cómo evitar el azar en los exámenes tipo test</b> Mercedes Soto González, Yoana González González, Eva M <sup>a</sup> Lantarón Caeiro e Iria Da Cuña Carrera .....	137
<b>22. La danza del pez espinoso: proyección de vídeo con y sin anotaciones para identificar elementos de argumentos e investigaciones científicas</b> Daniel Cebrián-Robles, Rafael Pérez-Galán y Natalia Quero-Torres .....	143

<b>23. Master en Plagas (“Pest Management”)</b> Miguel Ángel Hurtado Preciado, Jorge Valle Manzano, Luis A. Serrano Fraile, Miguel Hurta- do González, Emilio Mateos Yáñez y Santiago Vadillo Machota .....	149
<b>24. Reforma curricular de matemática en el Cole- gio Militar de la Nación Argentina</b> Melisa Proyetti, Vicente Messina, Marcela Sanguinetti y Guillermina Visca .....	155
<b>25. Evaluación del uso de recursos virtuales en prácticas de laboratorio de la asignatura de Ciencia de los materiales</b> José E. Martín-Alfonso, Antonio Abad Cuadri, Juan Urbano Baena y Jesús Fernández Arteaga .....	161
<b>26. Ensinar os quatro elementos da natureza na educação pré-escolar num laboratório de ci- ências do Ensino Superior</b> Maria Eduarda Ferreira e Guida Gomes .....	167
<b>27. Abordagem dos aspectos sociocientíficos na estrutura dos livros didáticos de ciências</b> Josiani Fátima Weimer Baierle, Caroline Fortuna e Rosana Franzen Leite .....	173
<b>28. Experiencia de ensino activo para matemáti- cas en titulacións universitarias</b> Miguel Brozos Vázquez, Ana Rodríguez Raposo, María José Pereira Sáez, María José Souto Salo- rio e Ana Dorotea Tarrío Tobar .....	179
<b>29. @Erizainbot, a mobile chatbot for facilitating learning and collaboration outside the class- room in Health Sciences Education</b> Leyre Echeazarra Escudero and Juanan Pereira Varela .....	185
<b>30. Materiais experimentais: explorando um la- boratório de Física sem utilização</b> Natan Trovó Lino, Eugenio Maria de França Ramos e Bernadete Benetti .....	191

<b>31. Eduardo Torroja y la influencia de las matemáticas en el proyecto de Arquitectura</b> Manuel de Miguel y Alberto Lastra .....	197
<b>32. A contação de histórias e o ensino de ciências: (re)significando os conceitos de alimentação saudável na sala de alfabetização</b> Cínthia Brinco Diniz e Guilherme Orsolon de Souza .....	203
<b>33. Análisis de la autoeficacia docente y conocimientos STEM en maestro en formación</b> Guadalupe Martínez-Borreguero, Milagros Mateos-Núñez y Francisco Luis Naranjo-Correa .....	209
<b>34. Conocimientos y habilidades STEM del alumnado de 3.º y 4.º de educación primaria</b> Milagros Mateos-Núñez, Guadalupe Martínez-Borreguero y Francisco Luis Naranjo-Correa .....	215
<b>35. Visión de profesores de ciencia en ejercicio sobre los factores que influyen en el cambio hacia una enseñanza basada en competencias. Un estudio de caso</b> Jose M. Hierrezuelo Osorio, Teresa Lupión Cobos y Ángel Blanco López .....	221
<b>36. Prácticas evaluativas en la formación docente en química. Una experiencia</b> Mario Rolando Molina y Rosa Magdalena Osicka .....	227
<b>37. La magia de las ciencias en un aula de educación primaria</b> Cristina Gil Puente, Marta González Juárez, Cristina Vallés Rapp y María Antonia López Luengo .....	233
<b>38. Importancia de la lengua inglesa en las ciencias veterinarias</b> Miguel Ángel Hurtado Preciado, Luis A. Serrano Fraile, Miguel Hurtado González y Santiago Vardillo Machota .....	239



<b>39. Las ciencias y la lengua inglesa. Un nuevo modelo educativo. Razones y esquema (I)</b> Miguel Ángel Hurtado Preciado, Luis A. Serrano Fraile, Miguel Hurtado González y Santiago Vardillo Machota .....	245
<b>40. Actividades de indagación en una propuesta didáctica sobre la elaboración del yogur</b> Verónica Muñoz-Campos, Antonio Joaquín Franco-Mariscal y Ángel Blanco-López .....	251
<b>41. Estudio de la oxidación como contexto: ideas previas en alumnado de 2.º y 3.º de ESO</b> Teresa Lupión Cobos, Mario Caracuel González y Ángel Blanco López .....	257
<b>42. Evaluación de la mejora del aprendizaje de ciencias en educación secundaria a través de actividades basadas en cine de ciencia ficción</b> M <sup>a</sup> Francisca Petit y Jordi Solbes .....	263
<b>43. Percepções de professores dos anos iniciais quanto às feiras de ciências: a participação e possíveis aprendizagens</b> Mônica da Silva Gallon, Sabrina Isis Brugnartotto Dopicco e João Bernardes da Rocha Filho .....	269
<b>44. O pensamento crítico na formação de professores: uma proposta para o ensino superior</b> Amanda R. Franco e Rui Marques Vieira .....	275
<b>45. Adquisición de competencias en alimentación en alumnado de Magisterio Educación Infantil</b> Beatriz Carrasquer y Adrián Ponz .....	281
<b>46. Uso de predicciones e hipótesis en la educación infantil para enseñar ciencias experimentales</b> Adrián Ponz y Beatriz Carrasquer .....	287
<b>47. É possível viajar no tempo? Uma proposição de aula a partir da abordagem multicultural</b> Danilo Almeida Souza .....	293

<b>48. Diseño e implementación de herramientas didácticas para detectar y combatir preconcepciones sobre luz y color</b> Francisco Luis Naranjo, Guadalupe Martínez, Ángel Luis Pérez, Pedro J. Pardo y M <sup>a</sup> Isabel Suero .....	299
<b>49. La indagación científica en la práctica docente en educación primaria</b> Elena Arboleya y Eduardo Dopico .....	305
<b>50. El aprendizaje estratégico y de las emociones empleando videojuegos para alumnado con déficit de atención (TDA) en clases de ciencias experimentales</b> María Dévora Cury Mederos, Maite Henríquez Adán-Luis y Miguel Ángel Negrín Medina .....	311
<b>51. O laboratório escolar (virtual) de Química – o que interessa?</b> Fabiana Gomes, Alexandre Luiz Polizel e Moisés Alves de Oliveira .....	317
<b>52. La oxidación en el aula de educación primaria</b> F. Javier Robles Moral .....	323
<b>53. Las TIC en la enseñanza y aprendizaje de las ciencias: propuesta de un entorno profesional personal de enseñanza (EPPE)</b> Juan José Marrero Galván, Cristina Afonso Olivares, Joel Iglesias Martín y Miguel Ángel Negrín Medina .....	329
<b>54. Construção e avaliação de um website para divulgação de pesquisas sobre resolução de problemas no ensino de Química</b> Angela Fernandes Campos e Amanda Pereira de Freitas .....	335
<b>55. Mediar a aprendizagem e aprender a ensinar ciências para crianças</b> Maria Nizete de Azevedo, Leonardo Testoni e Beatriz A. C. Castro .....	341

<b>56. Perfil do público escolar visitante do Museu de Zoologia da Universidade de São Paulo de 2016 a 2018</b>	
Márcia Fernandes Lourenço, Geyce Alvarenga Alves e Vanessa Sakai Gomes Pires .....	347
<b>57. Tecnologia educacional na formação em saúde</b>	
Olga Maria Ramalho de Albuquerque, Maria Fernanda Mascarenhas dos Santos Melis e Maria da Conceição Carrilho de Aguiar .....	353
<b>58. O pensamento crítico na formação continuada de professores/as: uma proposta para o ensino básico</b>	
Ana Sofia Sousa e Rui Marques Vieira .....	359
<b>59. A relação entre atividades lúdicas e aprendizagem: a construção de significados matemáticos na educação de jovens e adultos-EJA</b>	
Leiliane da Silva Luiz e Guilherme Orsolon de Souza .....	365
<b>60. Iniciativas de ativismo com alunos do 2.º Ciclo: agentes de mudança na promoção de uma cidadania ativa</b>	
Carolina Amaral e Elisabete Linhares .....	371
<b>61. Narrativas de asesores de ciencias: reflexiones sobre concepciones didácticas de maestros acerca de la indagación escolar en Costa Rica</b>	
Diego Armando Retana-Alvarado y Bartolomé Vázquez-Bernal .....	377
<b>62. Análisis de las analogías propuestas por una muestra de maestros en formación para la enseñanza de conceptos de ciencias de la naturaleza</b>	
José María Marcos-Merino, Rocío Esteban Gallejo y Jesús Gómez Ochoa de Alda .....	383
<b>63. ¿Pensamiento intuitivo o pensamiento científico? La persistencia de las ideas previas en estudiantes de distintos niveles educativos</b>	
José Hidalgo, Soledad De la Blanca y Consuelo Burgos .....	389

<b>64. Validación convergente de una escala de ítem único de actitudes hacia la ciencia escolar</b> Radu Bogdan Toma y Jesús Ángel Meneses Villagrà .....	395
<b>65. Concepciones sobre los científicos en alumnado de educación primaria</b> Radu Bogdan Toma, Ileana M. Greca y Martha Lucía Orozco Gómez .....	401
<b>66. Estudio de casos en un Máster de Prevención de Riesgos Laborales</b> Ana Gayol y Verónica Tricio .....	407
<b>67. Diseño de una propuesta didáctica sobre energía y cambio</b> Joel Iglesias Martín, Juan José Marrero Galván y Cristina Afonso Olivares .....	413
<b>68. Estudio de las percepciones de los estudiantes ante actividades no habituales para la enseñanza y aprendizaje de la cinemática</b> Cristina Afonso Olivares, Joel Iglesias Martín y Juan José Marrero Galván .....	419
<b>69. Metodologías aplicadas al estudio de un caso real: cierre de la central nuclear de Garoña</b> Andrés García Ruiz y María Dolores Castro Guío .....	425
<b>70. Abordar competencias docentes científicas y matemáticas desde una perspectiva interdisciplinar</b> Carolina Martín-Gámez y Catalina Fernández Escalona .....	431
<b>71. Enseñando a resolver problemas de cinemática mediante las TIC</b> Javier Viau, Alejandra Tintori Ferreira y Natalia Bartels .....	437
<b>72. Educação ambiental como prática por meio de um desfile de modas reciclável</b> Adriana de Andrade e Silva, Amanda da Cruz, Elisete Ferreira e Lia Maris Orth Ritter Antikeira .....	443

<b>73. O uso de mapas conceituais como instrumento facilitador da escrita</b> Guilherme Kunde Braunstein .....	449
<b>74. Concepciones sobre el aprendizaje en estudiantes secundarios</b> Guillermo Cutrera, Leonardo A. Funes y María B. García .....	455
<b>75. As contribuições da Sequência de Ensino Investigativo para a alfabetização em linguagem</b> Thiago Wedson Hilario e Ruberley Rodrigues de Souza .....	461
<b>76. Gestión de la participación y evaluación de los estudiantes mediante una aplicación móvil. Parte I: teoría y seminarios</b> Jenifer Santos García y Luis Alfonso Trujillo-Cayado .....	467
<b>77. Gestión de la participación y evaluación de los estudiantes mediante una aplicación móvil. Parte II: asignaturas experimentales</b> Jenifer Santos García y Luis Alfonso Trujillo-Cayado .....	473
<b>78. Elaboración y validación de un cuestionario para conocer los modelos expresados por los estudiantes sobre el fenómeno de las mareas</b> María Armario, José María Oliva y Natalia Jiménez-Tenorio .....	479
<b>79. Adopción de una nueva estrategia de “aprendizaje inverso” en una asignatura de ciencias</b> José Manuel Carmona, Susana Cebrián, Theopisti Dafní, Igor García, Gloria Luzón, Juan Carlos Martín y Juan Pablo Martínez .....	485
<b>80. Las ideas iniciales del alumnado de infantil y primaria: un espacio para reflexionar, investigar y diseñar</b> Bartolomé Vázquez-Bernal, Carmen Vázquez López y Diego Armando Retana-Alvarado .....	491

<b>81. Mapa de las habilidades cognitivas del ENEM</b>	
Maria Inês Martins y Felipe Canuto Franco .....	497
<b>82. ¿Qué emociones se exhiben al comienzo de una asignatura de ciencias? El caso del alumnado de Maestro de Primaria</b>	
Diego Armando Retana-Alvarado, María Ángeles de las Heras Pérez, Bartolomé Vázquez-Bernal y Roque Jiménez-Pérez .....	503
<b>83. Enseñanza basada en huerto en educación primaria: evaluación cualitativa de la motivación, la sensibilización ambiental y el aprendizaje del alumnado</b>	
Susan Rees, Marcia Eugenio y Guadalupe Ramos-Truchero .....	509
<b>84. Evidenciando a construção de significados, em uma sequência discursiva, sobre os estados físicos da água</b>	
Daniele Marçal Oleinik e Ligia Cristina Ferreira Machado .....	515
<b>85. Estrategias lectoras en estudiantes universitarios al leer textos científicos</b>	
Ana Barros Escalona, Ileana Greca Dufranc y Jesús Ángel Meneses Villagrà .....	521
<b>86. Adaptación curricular para el tratamiento práctico del tema energía y ondas</b>	
Mercedes Ruiz Pastrana, Amaya González de Garibay y Sandra Laso Salvador .....	527
<b>87. Las actitudes hacia la ciencia de los maestros de educación infantil</b>	
Sandra Laso Salvador, Mercedes Ruiz Pastrana y Alba Gloria Pérez .....	533
<b>88. Aprendizaje de la argumentación mediante dilemas. Experiencia interdisciplinar en un proyecto de coordinación</b>	
Antonio Joaquín Franco-Mariscal, Teresa Linde-Valenzuela, Cristina Raquel Luque-Guerrero y Manuel Cebrián-de-la-Serna .....	539

<b>89. Análisis conceptual de las plantas en libros de texto de 4.º de primaria</b> Juan Carlos Rivadulla-López y Raquel López-Figueroa .....	545
<b>90. Cómo enseñan las Ciencias de la naturaleza los maestros de educación primaria</b> Juan Carlos Rivadulla-López, Tamara Abuelo-Pombo y María Jesús Fuentes-Silveira .....	551
<b>91. Utilización de entrevistas individuales para indagar sobre los conocimientos y las actitudes de estudiantes de bachillerato sobre la aplicación biotecnológica de biorremediación</b> Cristina Ruiz González, Enrique Ayuso Fernández, Luisa López Banet y Enrique Banet Hernández .....	557
<b>92. Um relato das práticas educativas e socioambientais buscando o Pensamento Complexo desenvolvidas em um Centro de Educação Ambiental em Igrejinha-RS</b> Natalia Aparecida Soares e Maria Eloisa Farias .....	563
<b>93. Variables contextuales que determinan la valoración del trabajo en grupo del futuro profesorado de educación infantil y primaria</b> Manuel Vidal López y Pedro Membiela Iglesia .....	569
<b>94. La realidad aumentada en las aulas de ciencias de la naturaleza de primaria</b> Marisol Rodríguez-Correa y Juan Carlos Rivadulla-López .....	575
<b>95. O Ensino de Cosmologia no Brasil: um “estado do conhecimento” a partir de teses e dissertações</b> Sabrina Isis Brugnarotto Dopico, Mônica da Silva Gallon, Cristiane Ribeiro Schwantes e João Bernardes da Rocha Filho .....	581
<b>96. ¿Cuáles son las temáticas más relevantes para enseñar ciencia, según el futuro profesorado de educación infantil?</b> Marta Cruz-Guzmán, María Puig y Antonio García-Carmona .....	587

- 97. Uso del movimiento corporal y sensores de movimiento para mejorar la interpretación de gráficas en cinemática**  
María Orero, Jordi Solbes y Anna R. Esteve ..... 593
- 98. I Congreso de Estudiantes sobre Didáctica de las Ciencias Experimentales en la Universidad de Cádiz: experiencia educativa en el Grado de Maestro en Educación Primaria**  
Natalia Jiménez-Tenorio y Juan José Vicente Martorell ..... 599
- 99. Unha experiencia ALFIN para promover o consumo responsable na formación inicial de profesorado**  
Azucena Arias-Correa, Mercedes Varela-Losada, Uxío Pérez-Rodríguez, María M. Álvarez-Lires, María A. Lorenzo-Rial, Xabier Álvarez-Lires e Francisco Serrallé-Marzoa ..... 605
- 100. “Se nos ha colado un huerto en clase”**  
Sagrario Andaluz, Inés Ortega, María Ángeles de la Villa, Dolores San Miguel, Luisa Merino, Montserrat Cruz y Sergio Recio ..... 611
- 101. Caracterización de las concepciones de los docentes universitarios de ingeniería sobre “cómo se enseña”**  
Fabián Buffa, Lucrecia Moro, María B. García, Paola Massa y María A. Fanovich ..... 617
- 102. Investigação de erros conceituais sobre Astronomia nos livros didáticos de Ciências aprovados pelo PNLD de 2017**  
Ariela Batista de Souto Lima e Jeane Cristina Gomes Rotta ..... 623
- 103. Mapeamento pedagógico: um olhar sobre a formação de professores de Matemática que atuam na EJA**  
Vanessa Silva da Luz e Celiane Costa Machado ..... 629



- 104. Aprender a ensinar ciencias: unha proposta metodolóxica para profesorado en formación inicial**  
Azucena Arias-Correa, Mercedes Varela-Losada, Xabier Álvarez-Lires, María M. Álvarez-Lires, María A. Lorenzo-Rial, Francisco Serrallé-Marzoa e Uxío Pérez-Rodríguez ..... 635
- 105. Actividades para promover vocaciones STEM en las niñas**  
Encina Calvo Iglesias y Eva Aguayo Lorenzo ..... 641
- 106. Multimodalidade na aprendizagem de enzimas: a narração e a produção de imagens como estratègia de ensino**  
Lucas Roberto Perucci e Carlos Eduardo Laburú ..... 647
- 107. ¿Se debería tratar la lactancia materna en las clases de ciencia en educación primaria? Preguntamos al futuro profesorado**  
Mireia Illescas-Navarro, Marta Cruz-Guzmán y Ana M. Criado ..... 653
- 108. ¿Cómo perciben los futuros maestros el programa de formación de didáctica de ciencias experimentales?**  
Magdalena Valverde Pérez y Gaspar Sánchez Blanco ..... 659
- 109. Usefulness of the scientific poster in the learning of first-year university students**  
Raquel Rodríguez-González ..... 665
- 110. Análisis de las causas que reducen las tasas de éxito de una asignatura de física de primer curso en grados de Ingeniería Industrial**  
Maripaz Mateo, José Manuel Amado, María José Tobar, Armando Yáñez y Ginés Nicolás ..... 671

## **29. @Erizainbot, a mobile chatbot for facilitating learning and collaboration outside the classroom in Health Sciences Education**

**Leyre Echeazarra Escudero<sup>1</sup> and Juanan Pereira Varela<sup>2</sup>**

<sup>1</sup>Didactics of Mathematics and Experimental Sciences, Education and Sport Faculty, University of the Basque Country, UPV/EHU, leyre.echeazarra@ehu.es

<sup>2</sup>Languages and Computer Systems Faculty of Computing, University of the Basque Country, UPV/EHU, juanan.pereira@ehu.es

### **Abstract**

This randomized controlled study assessed the impact and utility of a chatbot through Telegram for teaching complex theoretical aspects of a science subject of the degree in Nursing, while practicing oral communication. Data on system utilization and user perceptions suggest that the chatbot prove to be a tool that facilitates learning and collaboration outside of the classroom.

### **Keywords**

Chatbots, M-Learning, Telenursing, oral communication.

### **Introduction**

The use of Information and Communication Technologies (ICTs) has increased significantly from the last decade of the twentieth century to the present. As a consequence, the ICT revolution has had important impacts on all levels of our lives, including teaching and learning (McLoughlin and Lee, 2008). Current educational research identifies the importance of supporting learning with communication technologies, creating environments that suit with today's digitally-minded students (Andone et al., 2007). Indeed, in the last decades, the use of ICTs in the processes of teaching and learning is becoming widespread in many universities across the Globe, including the degree in Nursing (Wilkinson et al., 2012), due to the relevance that ICTs are acquiring to help nurses to provide plan care, education and health promotion. It is a great opportunity for "Telenursing" (TN), but it makes essential the formation of professional nurses for the practice of TN in a safe, competent and ethical way (Eulàlia Juvé et al., 2007).

A core competency of TN according to the Competence Framework of the International Council of Nurses (ICN) is the therapeutic communication and

interpersonal relationships, made through the ICTs (Eulàlia Juvé et al., 2007). However, there is a lack of training regarding patient communication.

We suggest that early and appropriate communication training is necessary to help students achieve effective communication strategies with patients. Due to the limited time students spend with patients, an alternative to this is training with simulated patients (Berkhof et al., 2011). As Glick and Moore (2001) point out, “multimedia applications can achieve not only real-time connections, but also can help construct a virtual patient as a teaching-learning and evaluation platform”. In our study, we focused on nursing students’ ability to communicate with virtual patients, to whom they should orally respond to diverse questions related to theoretical contents of a science subject. This pedagogical approach fits within the theory of constructivism, due to the fact that the student is the main responsible of the elaboration of the answers, thus the creation of knowledge, being the teacher a facilitator figure (Piaget, 1970). To do so, they must use a Telegram chatbot called @Erizainbot, a popular instant messaging (IM) application used by millions of worldwide users. Even though using chatbots in education is not a new issue, what is really a fresh approach is to integrate those chatbots in the IM mobile application that the learners are using on a daily basis.

## **Objectives**

Through the implementation of this online application with access via smartphones and the analysis of data on system utilization and the perceptions of students about the chatbot, we pursued the following objectives:

1. Respond the question about whether the designed chatbot might be an educational tool easy to use due to its versatility and flexibility of use in time and space, and if it could be a useful tool to help students become more involved in the subject.
2. Respond the question about whether the designed chatbot might be a useful tool for improving oral expression, help students familiarize themselves with the task of communicating effectively.
3. Know what should be improved in the design of the chatbot for future versions.

## **Methodology**

### *Chatbot design*

A Telegram based custom chatbot system was built and used. A chatbot is a software agent that can engage in a conversation with one or more humans. The conversation can be in the form of text messages, voice or a combination of both. The chatbot was tailor-made, entirely programmed for being used in this course. First, users of the chatbot start a new voice challenge sending the */challenge* command to our chatbot, named @Erizainbot. Our bot asks the user some questions that they have to answer using short voice messages. The Telegram system

record users' voice-messages and save some metadata about each recording (who was the recorder, when was it recorded, duration, file system path, etc.) in a voice cache database. After that, our bot executes an assignment script to randomly assign some evaluators to each recording. For evaluating purposes, it offers an */evaluate* command that shows the evaluator his/her pending voice-recording assignments. After listening to each one, the bot asks the evaluator to assess the audio using a numerical grade from a 1-5 Likert scale for three evaluation criteria (information quality, communication skills and appropriate registry), taking as reference a rubric of evaluation previously facilitated by the teacher.

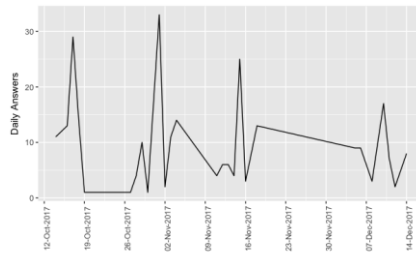
### *Participants and description of the experiment*

This experiment was implemented in the first year subject "Structure and Function of the Body" at the Nursing School of Vitoria-Gasteiz, which is an interdisciplinary subject that addresses core concepts about the structure and function of the human body. A total of 41 first-year nursing students took part in the study. All the students had smartphones and knew how to use the IM applications Telegram and Whatsapp, being the great majority active users of the latter. The initial knowledge of chatbots and their application were basic for both the students and the nursing teacher. The nursing students were randomly assigned to both the experimental group (chatbot) or to the control group (no chatbot). Both groups received identical theoretical training in the classroom. For the experimental group, the chatbot offered the student the possibility of answering 4 or 5 subject-related questions by voice, elaborated by a hypothetical friend, patient or family member, thus simulating real situations and practical questions. The control group was asked to answer the same set of questions but, this time, formulated in a more neutral way (without simulating real life situations) and that had to be answered by writing on a paper (without using the bot). Finally we asked both groups to answer a final question using the chatbot to record their voice answers. A third group (evaluators) was asked to evaluate those final question voice responses, acting as if they were such patient or family member. A technical log was maintained to collect data on system utilization. User perceptions were collected through a questionnaire at the end of the quarter.

## **Results**

### *Usage of the chatbot*

Data about the voice recordings (who recorded it, how long it was, when was recorded, to which question was it an answer...) was stored in a relational database. There were 4 challenges distributed during nearly 2.5 months (from 2017-09-30 to 2017-12-11) with a number between 5 and 6 questions for each challenge. A total of 272 voice files were recorded during the quarter. The distribution is shown in figure 1. As we can see, as each challenge deadline approached, there were recording surges, even for first (testing) challenge. The last question of the 4th challenge had an extended deadline (2017/12/14) thus the final peak.



**Figure 1.** Line chart with the number of daily answers

### *Students' perceptions*

The degree of satisfaction about the experience was evaluated through an online anonymous questionnaire that the students carried out at the end of the quarter. We asked our students to give their opinion about the utility of using a chatbot for voice-testing. From 27 answers, we summarize them as follow (multiple answers were possible, so percentages don't sum up to 100):

- 40 % (11/27) valued positively the option to review each subject using mobile based voice-tests, keeping it up to date.

- Some of them (2/27, 7 %) also highlighted that the bot helped them to involve more with the subject, because they tried to obtain the perfect audio-answer, what helped them to synthesize and be concrete and precise.

- Near 30 % (8/27) of the students underlined that the questions posed by the bot were practical, asking about everyday applications of the theory. One student said that "it is a way of learning by playing a professional role, trying to explain some technical concepts applied to everyday-life situations to non-professionals".

- Related to this, they also found themselves looking through their notes and additional sources of information. Specifically, they felt that this kind of reviewing was helpful for preparing the exam, besides being useful to favour the process of becoming an adult learner.

- Finally 22 % of the students (6/27) valued specially the availability of the bot for practicing whenever they want, in or out of the university setting, without any pressures. It fits each student schedule.

- They also described the experience as an original, entertaining and participative way of learning, which spurs their creativity skills.

We also wanted to know if recording their voices was a weird task for our users and if they felt comfortable or not with using their voices. Only 22 % of our students seem to feel comfortable recording their voices. Accordingly, 59 % seem to be uncomfortable generating voice answers (there is a 18 % that don't have an opinion here). 44 % of them declared they needed a specific space to practice voice-recording, what seems to be a real obstacle to practice (finding a suitable setting).

Regarding the question about if voice-recording exercise was a good option for improving their learning process, near 60 % of them agree or strongly agree with this idea, but there was a 26 % of them that were neutral about this item (and a minority, 15 % don't agree). Interestingly, when querying our students about their opinion regarding the usefulness of voice-messages for improving their cross-curricular competencies (oral expression, communication skills, ability to argue) the strong majority of them (85 %) agree with the idea (and nobody thinks the opposite).

We also asked them to highlight also the points that should be specially improved in future versions of the chatbot. The following lines summarize the aspects that the students consider should be improved: the bot should alert the students about the availability of new tasks (9/27); there is little time to answer (4/27); the option to change an already sent voice-answer should be easier (4/27).

### Conclusions

This study suggest that @Erizainbot via Telegram results to be a tool that facilitates learning and collaboration outside of the classroom, and that can be a useful approach to develop cross-curricular skills such as oral expression.

### References

- Andone, D., Dron, J., Pemberton, L. and Boyne, C. (2007). E-learning environments for digitally-minded students. *Journal of Interactive Learning Research*, 18 (1), 41-53.
- Berkhof, M., van Rijssen, H. J., Schellart, A. J., Anema, J. R. and van der Beek, A. J (2011). Effective training strategies for teaching communication skills to physicians: an overview of systematic reviews. *Patient Education and Counseling*, 84 (2), 152-162.
- Eulàlia Juvé, M., Huguet, M., Monterde, D., José Sanmartín, M., Martí, N., Cuevas, B. et al. (2007). Marco teórico y conceptual para la definición y evaluación de competencias del profesional de enfermería en el ámbito hospitalario. *Nursing* (ed. española), 25, 56-61.
- Glick, T. H. and Moore, G. T. (2001). Time to learn: the outlook for renewal of patient centred education in the digital age. *Medical Education*, 35 (5), 505-509.
- McLoughlin, C. and Lee, M. J. W. (2008). Mapping the digital terrain: New media and social software as catalysts for pedagogical change. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne* (pp. 641-652).
- Piaget, J. (1970). *Educación e instrucción*. Buenos Aires: Proteo.
- Wilkinson, A., Roberts, J. and While, A. (2012). Nursing students' use of technology enhanced learning: A longitudinal study. *Journal of Nursing Education and Practice*, 3 (5).

