



## ORIGINAL ARTICLE

## Does the level of realism of clinical simulators have an influence on empathy in Dentistry students?



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## KEYWORDS

Empathy;  
Simulated patients;  
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## Abstract

**Introduction:** Learning with phantoms in simulated dental offices allows students to develop not only skills but also empathy by recognizing the simulator as a real patient. This study investigates the level of empathy developed by 4<sup>th</sup>-year pediatric Dentistry students in a simulated scenario with two pediatric phantoms and analyzes whether the phantoms' degree of realism influences the established empathy.

**Methods:** A scenario was presented in a simulated dental office using two hand-made simulators: one involving a humanized mask -*ELLA junior*- and the other an Erler Zimmer phantom mask without the recreation of facial features. Two students performed the roles of dentist and assistant, and a professional actress was cast in the role of the mother. After the simulation, the Spanish-validated CARE questionnaire was distributed among 225 4<sup>th</sup>-year pediatric dental students, adding 4 questions on the level of perceived realism (obtaining 100% answers for empathy and 97.77% for realism). A statistical analysis was then carried out.

**Results:** The level of empathy for 9 out of 10 questions was "good". The dentist's positivity was the highest-rated empathy indicator whilst the interest in the patient-phantom remained the lowest. The phantom without humanization obtained a significantly better empathy mean value ( $36.86 \pm 43/31.19 \pm 9.72$ ), and no correlation was observed between the generated degree of realism and the empathy level obtained by students.

**Conclusion:** The level of empathy obtained by 4<sup>th</sup>-year dental students in the simulated scenario was good, not finding that the level of empathy improved when using a more realistic-looking phantom.

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## PALABRAS CLAVE

Empatía;  
Pacientes simulados;  
Entornos simulados;  
Estudiante de  
odontología

## ¿Influye el nivel de realismo de los simuladores clínicos en la empatía de los estudiantes de Odontología?

### Resumen

**Introducción:** El aprendizaje con fantasmas en consultas dentales simuladas permite a los estudiantes desarrollar no sólo habilidades sino también empatía al reconocer al simulador como un paciente real. Este estudio investiga el nivel de empatía desarrollado por estudiantes de 4º curso de Odontopediatría en un escenario simulado con dos fantasmas pediátricos y analiza si el grado de realismo de los fantasmas influye en la empatía establecida.

**Métodos:** Se presentó un escenario en una consulta dental simulada utilizando dos simuladores hechos a mano: uno con máscara humanizada -ELLA junior- y otro con máscara Erler Zimmer sin recreación de rasgos faciales. Dos estudiantes interpretaron los papeles de dentista y asistente, y una actriz profesional el de madre. Tras la simulación, se distribuyó el cuestionario CARE validado en español entre 225 estudiantes de 4º curso de odontopediatría, añadiendo 4 preguntas sobre el nivel de realismo percibido (obteniendo un 100% de respuestas para la empatía y un 97,77% para el realismo). Posteriormente se realizó un análisis estadístico.

**Resultados:** El nivel de empatía para 9 de cada 10 preguntas fue «bueno». La positividad del dentista fue el indicador de empatía mejor valorado, mientras que el interés por el paciente-simulador fue el peor valorado. El fantoma sin humanización obtuvo un valor medio de empatía significativamente mejor ( $36,86 \pm 43/31,19 \pm 9,72$ ), y no se observó ninguna correlación entre el grado de realismo generado y el nivel de empatía obtenido por los alumnos.

**Conclusión:** El nivel de empatía obtenido por los alumnos de 4º de Odontología en el escenario simulado fue bueno, no encontrando que el nivel de empatía mejorase al utilizar un fantoma de aspecto más realista.

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## Introduction

Fear and anxiety are emotions present in most dentistry patients, especially when it comes to children. It is essential to establish an appropriate and early professional-patient relationship to minimize these, and the degree of empathy was established between them being one of the key factors for improvement.

Many studies discuss the difficulty of defining the concept of empathy, although most agree it is a multifactorial quality that encompasses cognitive (recognizing and understanding another person's feelings) and emotional (feeling and sharing them) skills to which, in addition, some add a moral dimension (motivation to practice empathy) and behavioral or relational skills (providing a communicative and understanding response).<sup>1-6</sup>

From a healthcare point of view, Hojat<sup>7</sup> and Berg et al.<sup>8</sup> point out how the presence of the cognitive component takes priority over the emotional component. This is because it is more related to decision-making and diagnostic and therapeutic planning, although it must always be accompanied by a certain degree of affective empathy. In turn, this gives the practitioner understanding and demonstrates a humanized attitude towards the patient, thus establishing a dual process.<sup>9</sup>

Given that the ability to empathize is an indispensable factor in improving clinical outcomes, in certain professions (mainly healthcare), it is essential. This implies there is a call for educational programs and curricula to adopt

methods and design strategies that teach and/or improve this skill<sup>10,11</sup> - fundamentally its cognitive component<sup>12</sup> - emphasizing interactive communicative skills and early contact with the patient.<sup>13</sup> Different studies show how this empathic relationship in university students has been decreasing in the last decades, perhaps due to more demanding curricula in finishing modules, the prioritization of technical skills over humanistic ones and the lack of adequate training to confront certain sufferings, especially that of the most vulnerable groups.<sup>4,12</sup>

Simulation may be an appropriate method for teaching communication and empathy to healthcare students.<sup>14,15</sup> Even though the American Dental Education Association lists empathy as the second clinical competency in dental education and underlines its importance in the dentist-patient relationship,<sup>16</sup> simulation-based learning in dental degree programs relies almost exclusively on skills workshops on head phantoms with very little resemblance to a real patient.

As a result of technological progress, medical specialties have advanced anthropoid phantoms to train competencies with anatomy, physiology, voice programs and human-like reactions simulating the role of a patient. In dentistry, however, there are hardly any phantoms with realistic facial and physical features that allow students to establish a closer and more human connection with the simulator and train in scenarios with more ambitious communicative objectives, and the few simulators that exist are excessively expensive.

To improve the performance of skills workshops on traditional phantoms, a team of professors has created a full-body phantom with physical and facial anthropoid characteristics. The aim of this study was to investigate the level of empathy developed by 4<sup>th</sup>-year pediatric dentistry students in a simulated scenario with two pediatric phantoms (one with a humanized mask and the other without humanization) and analyze whether the degree of realism generated by each one of them has an impact on the empathy established between the student and the phantom.

## Materials and methods

### Study design

An observational, descriptive, cross-sectional study was conducted. This study is part of the research project titled "Impact of realistic simulation environments on student participants and observers" approved by the Ethics Committee. (CIPI/22.152).

### Sample

The study was carried out on 4<sup>th</sup>-year dental students in the Pediatric Dentistry III subject in the Universidad Europea de Madrid by performing a simulated dental office in a scenario of multiple dental traumas in a 4-year-old girl.

### Method

Two handmade, full-body phantoms (Halexia handmade simulator) were built from a modified Erler Zimmer head with the aim of developing empathic communication relationships with the patient on behalf of the students in their preclinical practice. The factory-made typodonts were replaced by pediatric Frasco typodonts allowing the correct simulation of the dental pathology: coronary fracture and extrusive luxation of three temporary upper incisors. The

learning objectives of the scenario included the correct treatment for dental trauma and to properly manage the behavior of the pediatric patient in the event of a dental emergency.

Prior to the development of the simulation, the team designed a data sheet including all the details of the scenario (material resources required, scenography, need for complementary tests, etc.) incorporating a detailed description of the role played by the actor, instructing him/her in the case raised and the possible actions expected from the dentist's decisions. The implementation of the case was carried out on different days, calculating the possible number of participating students in the Simulated Hospital classroom (25 per session).

One of the simulators was fitted with a humanized mask - *ELLA junior* realistic facial mask - (simulator A) and the other retained the mask lacking humanization - Erler Zimmer phantom mask - incorporating only a wig (simulator B) (Fig. 1). Both simulators were dressed in age-appropriate clothing in line with the patient profile, reproducing the full body physical characteristics of the pediatric patient.

These scenarios integrated both phantoms where the professor simulated a voice-over from a Gesell camera control room. Phantoms were rotated randomly simulating the same dental case in the 9 scenarios. Two students complemented this educational intervention by acting out the roles of dentist and assistant and a simulated participant (professional actress) as the mother to increase the level of realism and human attributions of the simulation. Before the scenario was performed, the students were briefed on the scene they were going to watch and were encouraged to participate by imagining what their own performance would have been like to encourage a more enriching debriefing. During the scenario, the student (dentist) carried out the anamnesis, examination, and diagnosis and issued a possible treatment of the case, taking care to establish active communication with the professional actress (role of the mother) and simulator (voice-over accomplished by the professor, expressing possible felt sensations, and answering the questions).



Figure 1 a) Simulator A b) Simulator B.

The Spanish-validated questionnaire CARE (Caring Assessment Instrument)<sup>17</sup> was distributed among 225 4th year Dentistry students after its completion and prior to debriefing. All participating students (observers and participants in the scene) evaluated the level of empathy the colleagues showed in the role of dentist with both simulators. Previously, they signed a consent form accepting their participation in the study. This questionnaire consisted of a total of ten questions with five Likert-type answers (Mediocre/Acceptable/Good/Very good/Excellent) reflecting both cognitive and affective empathy. The option "Not Applicable" was added for those situations where the students considered that the question was not applicable. The total scores were obtained by adding the individual scores in the single items, where a higher score correlates to a better level of empathy. The debriefing subsequently took place. To achieve the learning objectives, the professor addressed the students by sharing and analyzing the performances of the scenario members.

In addition, four questions with Likert-type answers rated from 1 to 10 were added to the same questionnaire to analyze the perception of the overall realism and of each of the component elements (dental office, simulator, and actor).

### Statistical analysis

Statistical analysis was performed with the SPSS program (version 25.0 for Windows). A descriptive study was first carried out where continuous variables were presented as mean  $\pm$  standard deviation (SD) and discrete variables as number (percentage), unless otherwise stated.

A comparative analysis followed. The Shapiro–Wilk test yielded a value of normality. Spearman's Rho correlation coefficients determined the associations between empathy and realism, and correlation and box plots were formulated to obtain a better visualization of the results. T-tests evaluated the difference between empathy as a function of whether the phantom was humanized or not.

Prediction models for a numerical variable were developed using linear regression models. The F-test and the coefficient of determination  $R^2$  measured the significance of these models. A value was considered significant for  $p < 0.05$ .

### Results

A total of 225 students filled out the CARE questionnaire on empathy (109 for simulator B and 116 for simulator A), while

only 222 were valid for the perception of realism (108 with simulator B and 114 with simulator A). Three questionnaires were considered null for realism assessment since they were not properly filled out, obtaining 100% answers for empathy and 97.77% for realism.

When analyzing the realism means of scenarios performed with both simulators separately, the highest realism was that of the actress ( $8.84 \pm 0.160$  with simulator B and  $8.82 \pm 0.161$  with simulator A) and the lowest for the phantom, with no differences between both ( $5.46 \pm 0.239$  with simulator B and  $5.46 \pm 0.233$  with simulator A) (Table 1).

When correlating the global realism perceived by the student with the different realisms analyzed (dental office, phantom, and mother's), a moderate correlation with the realism of the dental office ( $R = 0.623$ ) was obtained with respect to that of the phantom ( $R = 0.611$ ) and the mother (simulated participant) ( $R = 0.49$ ).

In relation to student empathy, the question obtaining the highest score was No. 7 ("Is positive") with a total score of 866 followed by No. 3 ("Listens to her attentively") (812). The item with the lowest score was No. 4 ("Is interested in her as a person") (658) with the highest number of "not applicable" responses (Table 2).

The average level of empathy was considered good, obtaining a mean between  $3.20 \pm 1.29$  and  $3.85 \pm 1.12$  for all the questions analyzed, except for question 4 ( $2.92 \pm 1.35$ ) (Table 3).

When analyzing empathy generated by both simulators using the Student's t-test, simulator B produced better empathy, these results being statistically significant ( $p < 0.05$ ). Contrasting results were obtained when analyzing the perception of realism yielded by both phantoms, finding no significant differences between them in the different scenarios. Both results were illustrated through correlation graphs in Fig. 2.

Finally, when analyzing the possible correlation between the level of empathy and the overall realism of the scenario, the Spearman correlation coefficient showed a slightly significant association ( $R = 0.283$   $p < 0.001$ ). On the other hand, when analyzing the level of empathy with the realism generated by the phantom, this association was not significant ( $R = 0.126$   $p:0.62$ ).

### Discussion

A close doctor-patient relationship is essential for achieving effective results in healthcare professions. A good empathic doctor-patient relationship has been proven to result in a

**Table 1** Levels of realism perceived by the students according to the phantom used.

	R.DO (A)	R.DO (B)	R.Ph. (A)	R.Ph (B)	R.Mot (A)	R.Mot (B)	R.Global (A)	R.Global (B)
Mean	7,35	8,06	5,46	5,46	8,82	8,84	7,11	7,64
Median	8	8	6	6	9	10	7	8
Deviation	1,95	1,62	2,48	2,48	1,71	1,65	1,86	1,23
Confidence interval	(6,99-7,71)	(7,75-8,37)	(4,99-5,92)	(4,99-5,94)	(8,51-9,14)	(8,53-9,16)	(6,76-7,45)	(7,40-7,87)

R. DO = Realism Dental Office; R. Ph = Realism Phantom; R. Mot = Realism Mother; R. Global = Realism Global.  
(A) = Simulator A; (B) = Simulator B.

**Table 2** Scores for each of the questions analyzed in the questionnaire.

	1 (ME)	2 (AC)	3 (G)	4 (VG)	5 (EX)	0 (NA)	Total, average
Q1 (225)	12	40	61	62	47	3	758
Q2 (225)	9	33	69	72	39	3	770
Q3 (225)	17	14	53	72	64	5	812
Q4 (225)	24	59	56	42	36	8	658
Q5 (225)	10	42	68	64	40	1	754
Q6 (225)	15	32	72	56	47	3	754
Q7 (225)	6	15	49	77	75	3	866
Q8 (225)	14	37	58	70	44	2	762
Q9 (225)	15	34	65	67	40	4	746
Q10(225)	25	40	60	56	42	2	719

(ME) = Mediocre; (AC) = Acceptable; (G) = Good; (VG) = Very Good, (EX) = Excellent; (NA) = Not Applicable.

Q1, Q2, Q3 [...] Q10 = Question 1, Question 2, Question 3 [...] Question 10.

decrease in anxiety and stress for both, obtaining more positive results and decreasing conflict, reducing possible patient complaints.<sup>4,5,7,17</sup> In line with this argument, a study carried out by Watanabe et al. using patient simulation shows how an empathetic attitude of dentists is a decisive factor in their relationship as well as patient satisfaction and proves that communication between both in the dental practice should focus not only on medical issues, but on the emotional needs of the patient as well.<sup>18</sup>

Multiple scales have been used to assess empathy within healthcare professions. The Jefferson scale is the most widely used<sup>8,10,13,15,18,19</sup> followed by the Interpersonal Reactivity Index (IRI) with 2 cognitive and 2 emotional dimensions. Following other authors,<sup>2,5,17,20</sup> the CARE scale validated in Spanish<sup>17</sup> was the chosen option because it contained items that were most appropriate for the study, considered as a valid and reliable tool with internal consistency when used on patients.<sup>21</sup>

In this study, students obtained good empathy scores in evaluated questions except for the question "is interested in her as a person" (corresponding to item 4 of the scale), perhaps due to the difficulty the student encounters when interpreting the child simulator as a real patient. Similarly,

Berg et al.<sup>8</sup> observe how students are sometimes skeptical of scenarios that simulate unrealistic environments, further indicating that the empathic relationship may require some time to develop.

Simulation can be an effective method for improving these behavioral skills and allow for an increase in empathy.<sup>14</sup> For some authors, simulation only has an influence on the cognitive component (the ability to understand another's perspective),<sup>3</sup> while others result in an increase not only in cognitive empathy but also in affective and behavioral empathy.<sup>1</sup> Students showed good levels of both affective and cognitive empathy in this study.

Different forms of simulation have proven effective in increasing empathy. Laughey et al.<sup>9</sup> offer twelve practical tips for the development of empathic skills through simulated patients, illustrating how to teach the ability to feel and express empathy. Role play can be valid as a first alternative for learning and is an inexpensive resource.<sup>22</sup> Some refer to the use of simulated patients as a better option,<sup>23</sup> but perhaps the most effective results are achieved when the student puts him or herself in the patient's place.<sup>22</sup> The problem in pediatric dentistry stems from the difficulty in using child actors as simulated patients due to the lack of specific regulations, ethical/legal considerations, and the possible risk of intervention, although authors such as Gamble et al.<sup>24</sup> bring up some recommendations and practical guidelines for the use of children and young people as simulated patients. Some authors argue how this range of simulation methods and techniques has a real impact on increasing empathy; although their long-term efficacy remains unknown, they can be considered as complementary support.<sup>25</sup>

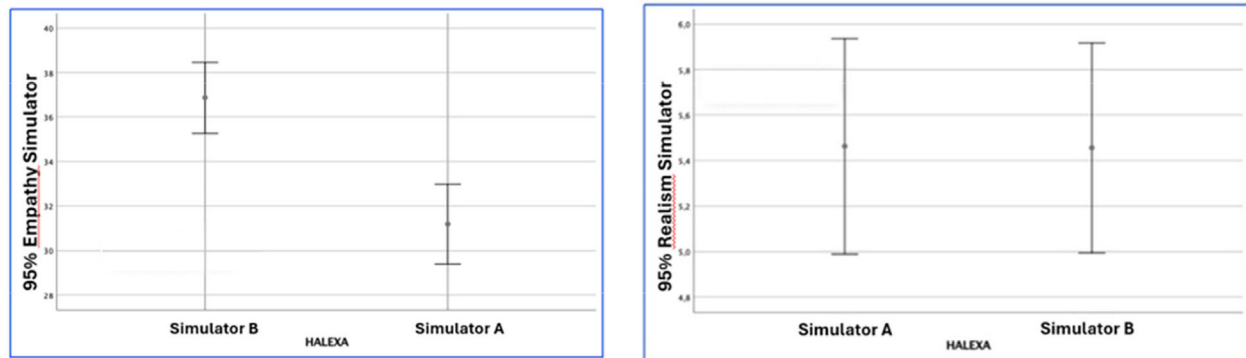
Learning in simulated dental practices with phantoms allows students to train in controlling emotions in a safe environment. The problems with simulators involve cost, fidelity and credibility, and there is much controversy over the advantages that high/low fidelity simulators can offer. A study by Guillett et al.<sup>26</sup> concluded that the use of high-fidelity simulators achieved similar results to patient actors in the creation of casualty simulations. Other studies obtain more positive evaluations for high-fidelity simulators, though not always significant,<sup>27</sup> while others find no significant differences when performing scenarios involving more or less realistic simulators, finding even worse results

**Table 3** Average value of empathy of the questions analyzed in the questionnaire.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
N val.	225	225	225	225	225	225	225	225	225	225
N lost	0	0	0	0	0	0	0	0	0	0
Mean	3,56	3,41	3,61	2,92	3,35	3,34	3,85	3,39	3,32	3,20
Median	3,00	3,00	4,00	3,00	3,00	3,00	4,00	4,00	3,00	3,00
Mode	4	4	4	2	3	3	4	4	4	3
SD	3,14	1,13	1,28	1,35	1,13	1,23	1,12	1,20	1,22	1,29
Minimum	0	0	0	0	0	0	0	00		0
Maximum	5	5	5	5	5	5	5	5	5	5
Percentiles 25	3,00	3,00	3,00	2,00	3,00	3,00	3,00	3,00	3,00	2,00
50	3,00	3,00	4,00	3,00	3,00	3,00	4,00	4,00	3,00	3,00
75	4,00	4,00	5,00	4,00	4,00	4,00	5,00	4,00	4,00	4,00

N val. = Valid questionnaires; N lost = Invalid questionnaires; SD = Standard deviation.

Q1, Q2, Q3 [...] Q10 = Question 1, Question 2, Question 3 [...] Question 10.



**Figure 2** Empathy and realism generated by both simulators.

with high fidelity, perhaps due to the resulting overconfidence in the students.<sup>28</sup>

The team carried out a previous study on realism in dental scenarios using a hand-made phantom with an unrealistic facial mask. Results showed that the lowest scores stemmed from the simulator.<sup>29</sup> The present study therefore set out to analyze whether anatomical appearance influences the students' perception of realism and empathy. For this purpose, clinical scenarios were performed using two phantoms simulating child patients: one with a more realistic facial appearance than the other. When analyzing the perception of realism results showed that, regardless of the phantom used, the simulator obtained the lowest score. Additionally, when comparing both simulators, no statistically significant differences were found between them, concurring with those who believe the function of the simulator to be more important than the anatomical appearance of the simulator.

No correlation between the level of empathy and realism was found. Differences were observed, however, in the level of empathy depending on the simulator used: contrary to what was expected, the lower fidelity simulator generated a higher degree of empathy. One explanation for this result could rest in the difficulty of assuming the phantom as a real human patient and that, when demonstrating emotion, the less humanized phantom generated a greater feeling of compassion in the students given its worse physical appearance. "Pity or compassion", however, cannot be mistaken for "empathy", the first two being emotional and reactive responses while empathy, as mentioned, is an affective and cognitive fact.<sup>30</sup> Similarly, Riess<sup>19</sup> conducted a study in nursing students to determine whether the type of fidelity chosen in simulation has an impact on the level of empathy. He found no differences in the increase in empathy following the scenario with simulated patients and high-fidelity phantoms. The team shares this belief that empathy and the best type of fidelity require more research so as to conclude that a higher degree of realism in simulations enhances empathy in students.

It can be concluded that simulated scenarios by 4<sup>th</sup>-year dental students developed a good level of empathy, finding no relation to the degree of realism generated by the simulator. The lower fidelity simulator produced a significantly higher level of empathy.

One of the limitations of the study involves the issue of carrying out the scenario in 4th year students given they

have already begun clinical practice, making it more difficult for them to compare phantom credibility with their real daily patient practice. Another limitation is the sample size (225 students). It may be necessary to broaden the sample for future research and consider the tendencies of empathy according to gender as well as the academic year students are enrolled in, to observe if, as other studies state, women and the early stages of the degree show more empathy.

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This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Universidad Europea de Madrid (CIPI/22.152).

Informed consent was obtained from all individual participants included in the study.

## Conflict of interest

The authors declare no conflict of interest. The funders (Universidad Europea de Madrid, Grant ID 2022UEM15) had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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