

Student perception of early simulation in dentistry.

Percepción de los alumnos respecto a la primera simulación clínica en la carrera de Odontología.

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Abstract: Objective: To evaluate student perception of early simulation in dentistry. **Material and Methods:** The design of the study was quantitative, observational and cross-sectional. A total of 121 students, from third year to senior year were evaluated. The perception and its dimensions: satisfaction, self-confidence and good educational practices were evaluated by a survey with a high level of reliability (0.89), modified and adapted for the present investigation, checking coefficients for its use: Aiken's V, Cronbach's Alpha, Test-Retest (Spearman), classified in ability, scenario and general simulation practices, based on the Likert scale (from 1 to 5). For the univariate analysis, the descriptive statistics from qualitative and quantitative variables were obtained and for the bivariate analysis, Spearman's rank correlation coefficient and Kruskal Wallis and Mann-Whitney U-tests were employed. **Results:** The students rated the simulation perception positively with an average of 4.42 ± 0.49 , 4.14 ± 0.63 y 4.73 ± 0.66 regarding the ability, scenario and general simulation practices, respectively. No statistically significant differences were found between the perception of early preclinical practices with the variables age, gender, year of study and previous experience. **Conclusion:** The perception of students regarding early preclinical practices got a high score and it is not related with the variables studied, according to the survey modified and adapted.

Keywords: *Simulation training; patient simulation; self-concept; dental education; learning; clinical clerkship.*

Resumen: Objetivo: Evaluar la percepción de los alumnos respecto a la primera simulación clínica en la carrera de Odontología. **Material y Métodos:** El diseño del estudio fue de tipo cuantitativo, descriptivo y transversal. Se evaluaron 121 alumnos de sexto a décimo ciclo. La percepción y sus dimensiones: satisfacción, autoconfianza y buenas prácticas educacionales fueron evaluadas mediante una encuesta con alto nivel de confiabilidad (0.89), modificada y adaptada para la presente investigación comprobando coeficientes para su uso: V de Aiken, Alfa de Cronbach, Test-Retest (Spearman), clasificada en prácticas de habilidad, escenario y simulación en general, basada en la escala de Likert (1 al 5). Se obtuvo la media y desviación estándar para la variable percepción, así como el coeficiente de correlación de Spearman y las pruebas U de Mann Whitney y Kruskal Wallis para evaluar covariables. **Resultados:** Los estudiantes tuvieron una percepción

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positiva respecto a la simulación obteniendo una media de puntuación de 4.42 ± 0.49 , 4.14 ± 0.63 y 4.73 ± 0.66 respecto a las prácticas de habilidad, escenario y simulación en general respectivamente. No se encontraron diferencias estadísticamente significativas entre la percepción de la primera simulación clínica con las variables edad, género, ciclo y experiencia previa. **Conclusión:** La percepción de los

estudiantes respecto a la primera simulación clínica obtuvo un alto puntaje y no se encuentra relacionada con las variables estudiadas según la encuesta modificada y adaptada.

Palabra Clave: Entrenamiento simulado; simulación de paciente; autopercepción; educación en odontología; aprendizaje; prácticas clínicas.

INTRODUCTION.

Dental programs aim to train professionals by successfully integrating the cognitive, attitudinal, and procedural dimensions. In these programs, students are provided with the essential theoretical and clinical knowledge to become skillful and reputable dentists at the end of their professional training.¹ There are different rationales for the use of simulation, such as improving the patient's safety and facilitating the development of the student's skills and intellectual capacity. For this purpose, simulators are used in different clinical scenarios.²⁻⁴

Recent research carried out in various countries has shown that simulation is a positive learning methodology for students. It has proved to be an effective strategy to develop hard and soft skills, positioning itself as a first-level tool, widely contributing to the learning process,⁵⁻⁹ particularly when compared to dental programs that have not yet implemented this approach.

Some studies carried out in China⁸ and the United States⁹ report that simulation stimulates and facilitates learning and can be considered a viable option in the training of students. However, it is essential to evaluate the perception of the students, which is defined as the interpretation that an individual makes of a situation through sensations and impressions that they capture from the outside through their senses in relation to their first experience with simulation.¹⁰ The dimensions that this study addresses are: satisfaction, self-confidence, and good teaching practices, since the vision of the students is essential to verify the usefulness of this methodology.¹¹⁻¹³

The studies also report that the perception of the simulation could be influenced by other factors specific to each student, such as age, gender, year of study (level), and previous experience.^{12,13}

This teaching methodology makes use of various resources such as plaster models, and radiographs, among others, which have significantly improved thanks to the technological advance in phantoms and typodonts models, and the use of simulated standardized patients. These resources contribute to the development of motor, visual, auditory, and soft skills in students.¹⁴ It could be thought that these developments, in turn, have modified and improved the perception of students regarding hard skills. Likewise, positive perception lies mainly in the correct implementation of the methodology regardless of the type of resources.¹² Despite this, the perception of students about the role of simulation in dental training continues to be debatable as there are not enough data to support its use.

Consequently, the present research aims to evaluate the students' perception regarding their first simulation experience in the dental program. This consists of the realization of simple and compound cavity preparations in restorative treatments and the process they involve, in addition to the simulated scenarios sessions, in which the entire standardized patient care process of the aforementioned treatments is carried out.

MATERIALS AND METHODS.

Quantitative, observational, and cross-sectional study, which included students between the sixth and tenth levels of the undergraduate dental program at Universidad Peruana de Ciencias Aplicadas (UPC), which comprised a total population of 153 students during the period 1-2020.

The mean estimation formula of the EPIDAT 4.1® program was used to calculate sample size. For this, a precision of 2%, a confidence level of 95%, and a standard deviation of 12.9 were used, following the

methodology described by Escudier *et al.*,⁶ Finally, the sample considered 121 students who met the selection criteria. Students under 18 years of age and those who had taken the course “Preclinical Dental Practices 1 (PPCO1)” twice were excluded from the study.

Instrument for the evaluation of perception

The survey used was based on a compilation of 2 questionnaires extracted from the study published by Zapko *et al.*⁹ Both questionnaires were validated by the National League for Nursing¹⁵ and are highly reliable, obtaining a Cronbach's Alpha of 0.92 and 0.86 in the nursing program.⁹ In that program, they were used to evaluate the following dimensions of perception with respect to simulation: satisfaction in current learning, self-confidence in learning, and good teaching practices.

The questions went through a process of translation, back translation, modification, and adaptation so that they were properly aimed at dental simulation and presented a classification in skill, scenarios, and simulation practice in general, resulting in a total of 21 questions that later went through expert judgment. Each classification includes questions directed at the 3 dimensions of perception. Each question has 5 response alternatives based on the Likert scale, where:

- 1 = Completely disagree;
- 2 = Strongly disagree;
- 3 = Neither disagree nor agree;
- 4 = Strongly agree;
- 5 = Completely agree.

Expert judgment and measure of validity of the instrument

Expert judgment was obtained from 5 specialists who had at least 3-5 years of experience in simulation and/or knowledge of instrument validation. The experts evaluated each question under the criteria of clarity, coherence, and relevance. The data provided was useful to verify content validity using Aiken's V, obtaining a result of 0.98, that is, the content of the instrument is adequate, valid, and relevant for its application.

Measures of agreement and reliability of the instrument

A pilot test was applied to 20 students to evaluate the agreement and reliability of the instrument. The correlation of the data was calculated using the "Test-Retest" method through the Spearman statistical test, obtaining a result of 0.81, which indicates a strong and positive correlation.

In addition, the reliability of the instrument was determined using the Cronbach's Alpha statistical test, obtaining a value of 0.89, which indicates that the instrument has excellent reliability, and that the data obtained from it are accurate and consistent.

Audiovisual material

Audiovisual material was developed and used so that students were able recall the content seen in the course “Preclinical Dental Practices 1” to reduce memory bias.¹⁶ The video contained restorative treatments for simple and compound cavities, and the following procedures: absolute isolation, removal of the lesion, restoration with resin, and polishing. Also, practices in specific scenarios were included, in which an actor plays the role of a patient so that students can carry out the care process from anamnesis to a treatment plan of the procedures learned in the skills practices. The video was evaluated by a specialist in the subject. Additionally, a virtual focus group composed of 10 randomly selected students was used for the evaluation of the video considering criteria such as appeal, acceptance, identification, understanding, and induction to action. The video was streamed through the virtual platform Zoom®. Finally, it was concluded that the use of audiovisual material was an excellent tool to reduce memory bias in the present study.

Application of the instrument

Students were sent a link to enter the Google Forms® platform through social networks such as Facebook® and WhatsApp®. The survey was divided into 3 sections: Informed consent, audiovisual material, and the 21 questions. The instrument evaluated the main variable: Perception, and was complemented with variables, such as age, gender, year of study (level), and previous experience. The responses were registered in a Microsoft Excel® database, and were later confidentially managed.

Analysis of data

The analysis of the study was carried out using the statistical package STATA 14.0® (College Station Statacorp, Tx, Stata Press, US). For the univariate analysis, the descriptive statistics of the qualitative variables (absolute and relative frequencies) were obtained; and of the quantitative variables (mean and standard deviation). In addition, for the quantitative variable age, measures of central tendency and dispersion (median and interquartile range) were calculated. The Spearman correlation coefficient was used for the bivariate analysis

to correlate quantitative variables. Mann Whitney U and Kruskal Wallis test were use for comparison according to the different covariates of the study, considering a level of statistical significance of ($p < 0.05$).

RESULTS.

Of the total studied sample that consisted of 121 students (Figure 1), it was found that most of the students evaluated simulation positively as part of their learning process, since their perception of the

first simulation presents a mean of 4.32 according to the Likert scale that ranged from 1 to 5.

General characteristics of the study population: 91 females, accounting for (75.21%), median age of the population: 22 years. The seventh and tenth levels have a total of 37 students (30.58%). Regarding previous experience, 90 students (74.39%) stated that they had already had some experience. (Table 1)

Regarding the evaluation of the students' perception regarding the first dental clinical simulation, it was

Figure 1. Study participation flowchart.

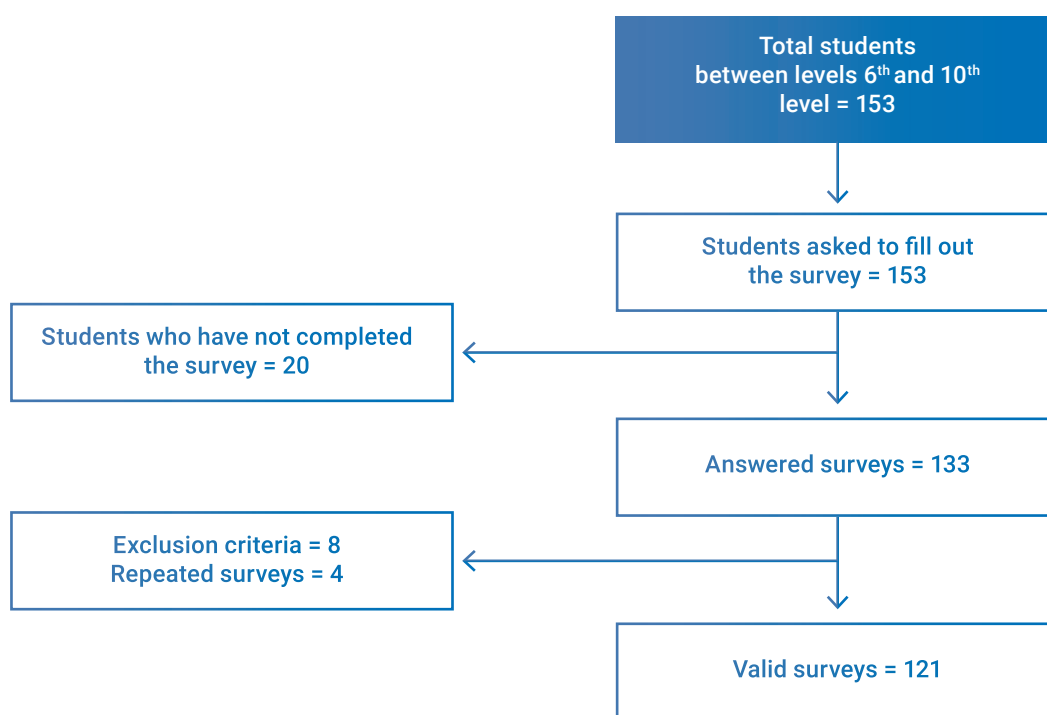


Table 1. General characteristics of the surveyed students (n=121).

Variables		n (%)
Age*		22 (3)*
Gender	Female	91 (75.21)
	Male	30 (24.79)
Academic level	Sixth	14 (11.57)
	Seventh	37 (30.58)
	Eighth	24 (19.83)
	Ninth	9 (7.44)
	Tenth	37 (30.58)
Previous experience	Yes	90 (74.39)
	No	31 (25.62)

*Median (Interquartile range)

Table 2. Evaluation of the perception of students regarding the first dental preclinical practices (n = 121).

	Mean	SD
SKILLS	4.42	0.49
SATISFACTION WITH CURRENT LEARNING	4.49	0.65
1. The simulation skills training sessions were useful and effective to develop clinical skills	4.48	0.77
2. The repetition of the procedures in the skills training sessions helped me to acquire greater manual dexterity skills	4.50	0.67
SELF-CONFIDENCE IN CURRENT LEARNING	4.45	0.72
3. I am sure that the simulation practice includes important and necessary content for mastering the clinical environment	4.45	0.78
4. The feedback given by the teachers helps me to guide my knowledge	4.44	0.80
GOOD TEACHING PRACTICES	4.32	0.65
5. Skills training sessions complement the cognitive part of my learning	4.58	0.65
6. The resources used such as: typodont, and simulator phantom head were useful for skills training	4.49	0.77
7. In the simulation practice I had the documentation (theory) necessary to be able to develop the skills sessions	3.89	1.07
SCENARIOS	4.14	0.63
SATISFACTION WITH CURRENT LEARNING	4.14	0.75
8. I feel that the simulation scenarios helped me with the management of the patient in a real clinical environment	4.11	0.89
9. The simulation scenarios enhance my cognitive knowledge in relation to diagnosis and treatment plan	4.17	0.81
SELF-CONFIDENCE IN CURRENT LEARNING	4.19	0.80
10. The discussions held to review the activities in the simulation scenarios promote my autonomous learning	4.27	0.83
11. The simulation scenarios have improved my soft skills for patient care in a clinical setting	4.10	0.89
GOOD TEACHING PRACTICES	4.10	0.76
12. The simulation scenarios were related to the theoretical contents seen during the program	4.47	0.76
13. The simulation scenarios applied in the course simulated a context as close as possible to the clinical environment	3.72	1.09
GENERAL	4.73	0.66
SATISFACTION WITH CURRENT LEARNING	4.40	0.76
14. My experience in clinical simulation has been satisfactory and valuable	4.41	0.80
15. I am sure that I have met the objectives in the simulation area	4.47	0.78
16. I enjoyed the way the simulation sessions were carried out	4.32	0.93
SELF-CONFIDENCE IN CURRENT LEARNING	4.30	0.79
17. This experience improved my performance in the real clinical environment	4.30	0.82
18. The experience with the simulation course has improved my confidence during the patient care process	4.29	0.85
GOOD TEACHING PRACTICES	4.43	0.63
19. Simulation has helped me to integrate my theoretical, practical, and attitudinal knowledge	4.40	0.79
20. The way in which the simulation practices were carried out were adequate for my way of learning	4.39	0.87
21. I had the opportunity to express my emotions and knowledge autonomously during the simulation activities	4.43	0.66

Table 3. Perception regarding the first preclinical dental practices according to general characteristics of the students (n = 121).

Perception of the first preclinical practices													
Variables	Perception of skills practices				Perception of scenario practices				Perception of simulation in general				
	Mean (S.D.)	Median	IQR	p-value	Mean (S.D.)	Median	IQR	p-value	Mean (S.D.)	Median	IQR	p-value	
Age	0.082 [£]	4.55	0.66	0.371*	-0.107 [£]	4.16	1.00	0.241*	0.007 [£]	4.50	0.88	0.937*	
Gender	Female	4.43(0.64)	4.61	0.72	0.149 [§]	4.11(0.67)	4.16	1.00	0.424 [§]	4.33(0.72)	4.38	1.00	0.678 [§]
	Male	4.37(0.42)	4.36	0.66		4.23(0.50)	4.33	0.83		4.48(0.44)	4.63	0.66	
Previous experience	Yes	4.47(0.49)	4.58	0.72	0.189 [§]	4.13(0.59)	4.16	1.00	0.380 [§]	4.41(0.56)	4.55	0.88	0.726 [§]
	No	4.26(0.81)	4.44	0.61		4.17(0.74)	4.33	0.83		4.26(0.88)	4.33	0.88	
Academic level	Sixth	4.53(0.35)	4.63	0.66	0.298 [¶]	4.38(0.44)	4.41	0.83	0.127 [¶]	4.51(0.38)	4.55	0.72	0.239 [¶]
	Seventh	4.36(0.58)	4.55	0.77		4.2(0.51)	4.16	0.83		4.37(0.63)	4.61	0.83	
	Eighth	4.39(0.94)	4.72	0.69		4.18(0.89)	4.50	1.25		4.41(0.97)	4.72	0.69	
	Ninth	4.64(0.36)	4.66	0.55		4.18(0.56)	4.16	0.83		4.54(0.46)	4.77	0.66	
	Tenth	4.40(0.42)	4.44	0.55		3.96(0.60)	4.00	0.83		4.25(0.57)	4.22	1.11	

£ : Spearman's Rho. * :Spearman's correlation test. § :Mann Whitney U Test. ¶ : Kruskal Wallis test. Significance level, p-value (p<0.05). S.D : Standard deviation. IQR : Interquartile range

observed that both the perception regarding the skill practices, scenarios, and simulation in general presented a mean greater than four: 4.42±0.49, 4.14±0.63, and 4.73±0.66, respectively. Similarly, when evaluating the dimensions of perception in each classification of the simulation, it was found that students have greater satisfaction in skills practices (4.49±0.65); self-confidence in scenarios practices (4.19±0.80); and that they evaluate good teaching practices positively throughout the course giving it a high score (4.43±0.63). (Table 2)

No statistically significant differences were found between the perception of skills practices, scenarios, and simulation in general in relation to the variables of gender, level, age, and previous experience. (Table 3)

DISCUSSION.

Regarding the main variable, perception, various studies show that there are different methods for its evaluation such as: interviews, focus groups and surveys. The latter method was used, which showed several advantages for the participants such as the short time used for responding, easy understanding, and skills classifications for better guidance. Likewise, it offers several advantages for researchers, since it provides numerical data, which facilitates statistical analysis and

interpretation. Various international studies use similar surveys to evaluate the perception of simulation in different health areas.^{3,12,17-20}

The students who participated in the study perceive the first simulation practice in a positive way, as a contribution to their learning process. This finding coincides with previous studies on simulation in the nursing program such as that of Zapko *et al.*,⁹ and Valen *et al.*,²¹ who reported positive results in the perception of students, providing strong support for using simulation, since it is the most promising method for acquiring knowledge, developing skills and attitudes. Similarly, in the field of medicine, Olson *et al.*,²² carried out a research with the aim of studying perception regarding the integration of experiences in simulation, in which students perceived that the practices were beneficial to acquire theoretical and practical knowledge.

Regarding the dental program, Haralur *et al.*,² showed that 100% of the students evaluated simulation favorably stating that it provides them with better clinical training. Likewise, Fernández *et al.*,¹² obtained a high evaluation of the perception regarding the usefulness of simulation in the development of hard skills. In addition, in a recent study in which the perception of the use of standardized actors was evaluated,

Zuñiga *et al.*,²³ found that students expressed a high evaluation (98%) regarding the development of communication skills and improved performance with real patients. However, it should be noted that these studies only evaluated the operation of the simulators, but not the entire process that the student goes through, as it was done in the present study. The present research also evaluates the perception of the simulation considering teacher participation, feedback, *prior* documentation, and supplemental resources, in addition to the practice.

The present research as well as various other studies indicate that simulation as a teaching method is well perceived by students.^{12,24,25} These results may be due to the fulfillment of the 11 essential characteristics to carry out a correct simulation session described by Gaba,²⁶ which are: explaining the purpose and objectives, collective participation, level of difficulty for each individual, mastery of the care process, application of the simulation in each work area, addressing knowledge, skills, attitudes, and behaviors, taking into account the age of the simulated patient, the applicable or required technology, adequate facilities, student participation, and feedback from the simulation. In turn, the students stated that they get greater satisfaction with respect to skills practices, this may be due to the constant repetition of dental procedures that facilitate the development of manual dexterity skills.

On the other hand, regarding the evaluation of scenarios, students reported that they help them acquire greater self-confidence. This improvement can be evidenced by the presence of standardized actors, who help students to put into practice all their stages of patient care.²⁷

Regarding the evaluation of the simulation in general, students have given a high score to good teaching practices, this may be due to the correct implementation of the practical sessions in relation to the active participation of the teachers, proper use of theoretical and practical materials, and the correct sequence of the session.^{1,9,28,29}

No association was found in the perception of skill, scenarios, and simulation practices in general with the variables age, gender, level, and previous experience. Regarding age, a study, carried out by Fernández *et al.*,¹⁴ in Barcelona stated that the perception regarding simulation does not show differences according to age, a result that coincides with the present study. Regarding gender, no

association with perception was found. However, a greater number of females were evaluated, a result that also coincides with studies carried out by other authors.^{8,9,28}

On the other hand, regarding the year of study or level of the students, the present results are in agreement with Zapko *et al.*,⁹ and Giménez *et al.*,⁴ who reported that students of final and initial years of the program perceive simulation as a very realistic tool. Finally, with respect to the variable prior experience, no significant relationship was found, unlike the study by Fernández *et al.*,¹³ who described that participants with previous experience had a direct correlation with better self-perception compared to students without it.

The results found in the present research regarding the association of perception with the variables age, gender, level, and previous experience, could be due to the fact that there is no direct influence of personal characteristics or from the environment on the participants, since their perception is based mainly on specific simulation practices, teaching methodologies, technology used, diversity of simulators, and the way in which these characteristics influence their learning experience.^{8,9,28}

Based on this, it is important to note that the differences found in the association of perception with previous experience could be linked to the definition of the last mentioned variable, since the present research considered it as an approach to the dental program regardless of simulation and/or clinical practices, unlike the study by Fernández *et al.*,¹² who differentiated the participants by means of a specific previous experience of a practical session and of the same type of simulator, reaching the conclusion that the repetition of the procedures influences perception.⁷

The present study has certain limitations regarding the participants' memory bias, because it was the first dental simulation performed that was evaluated, for which audiovisual material was used, as well as the application of the questionnaire in a single educational institution. It is advisable to continue with this type of research to improve the teaching and training process.

A comparison of the use of various resources in the simulation could be made to check if perception is modified based on these. Likewise, specific practices could be evaluated immediately after performing them, which would allow the inclusion of more variables that may influence students' perception.

CONCLUSION.

By means of the modified and adapted questionnaire for the present study, the evaluation of the perception regarding the first dental simulation practice obtained a high mean value greater than 4 out of 5. Regarding the dimensions of perception, the students evaluated the satisfaction in skills practices with a higher score, self-confidence, scenarios, and good teaching practices in simulation evaluation in general. In addition, it should be noted that perception is not related to the age, gender, level, or previous experience of the respondents.

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