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Influence of socio-demographic characteristics on the evaluation of effectiveness of medical simulation

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Abstract

Introduction and Objective. Learning effectiveness is a key element in the educational process that determines how effectively students can assimilate, store, and apply the knowledge acquired. There are many approaches and theories in the research literature exploring the different aspects of this process. Factors influencing learning effectiveness include learning style, motivation, learning techniques, and learning environment. Learning effectiveness also depends on individual student characteristics, including socio-demographic characteristics. The aim of the study is to verify the influence of socio-demographic characteristics on the assessment of the effectiveness of medical simulation as a learning method, using the standardised EPQ tool.

Material and Method. The study was conducted between 2023–2024 among 306 nursing students by means of a diagnostic survey, using the survey instrument EPQ.

Results. The surveyed students rated the educational techniques best in terms of collaboration. Statistical analysis showed a weak negative correlation between age and the evaluation of active learning, expectations, and the overall evaluation of educational techniques. Statistically significant results were obtained in the correlation of place of residence with the evaluation of educational practices.

Conclusions. The study showed a general relationship of the influence of selected socio-demographic characteristics on the evaluation of educational practices in medical simulation. Despite the occurrence of a relationship, the age of the subjects did not determine the outcome of the simulation effectiveness evaluation. There is a lack of detailed research in the available literature on the influence of socio-demographic variables on the evaluation of medical simulation educational practices, which allowed the identification of a research gap (white gap).

Key words

evaluation, effectiveness, medical simulation, socio-demographic characteristics, research gap

INTRODUCTION

In an era of changing approaches to the education process of future health care professionals, the practical skills of practising the profession occupy an extremely important place. The transition from a purely theoretical teaching model to the method of medical simulation is becoming a cornerstone of the process in medical faculties [1]. Medical education has undergone a significant transformation in recent times, largely due to the integration of simulation-based teaching methodologies [2, 3]. Medical simulation is a tool that allows clinical competencies to be developed during the actual training process. It makes it possible to build professional experience without stress for both students and patients concerned about the lack of adequate practical skills of young professionals [4]. The changing healthcare services landscape, med-tech developments, and patient safety, quality, and accreditation requirements are driving new content, goals, and models in health disciplines' education and practice [5].

Interprofessional training of medical professionals is only possible through the use of appropriate practical tools, which is provided by medical simulation. As a result, trainees entering the labour market have more practical skills, which allows reduction in the risk of medical errors [6]. Innovative teaching methods, such as simulation, improve abilities related to interprofessional learning [7]. Building competence and professional experience with the use of medical simulation is high and positively evaluated in studies on the effectiveness of the educational process [8]. Learning effectiveness is a key element in the educational process that determines how effectively students can assimilate, store, and

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apply the knowledge they acquire. As indicated by scientific literature, the factors influencing learning effectiveness are comprised of three main elements: learning style, motivation, and learning techniques. The learning environment is also considered a contributing factor. Learning effectiveness also depends on individual student characteristics, including socio-demographic characteristics [9]. The assessment of the effectiveness of the medical simulation method among nursing students, similarly to the situation in general education, may be influenced by factors such as age, place of residence, marital status or the fact of having children.

As reported in the literature, there is a need to further individualise interprofessional simulation-based educational programmes based on cultural differences and socio-demographic characteristics of the students and to design studies that examine long-term outcomes [5]. Due to the research area, the material presented in this article is unique and makes an important contribution to the development of knowledge on the effectiveness of medical simulation education.

OBJECTIVE

The aim of the study is to verify the influence of socio-demographic characteristics on the evaluation of the effectiveness of medical simulation as a learning method, using the standardised Educational Practices Questionnaire (EPQ) tool. The study analysed how socio-demographic characteristics (such as age, place of residence, marital status, and having children) influence nursing students' evaluation of the effectiveness of medical simulation. In addition, it aims to identify possible relationships between these factors and the perception of the educational benefits of simulation.

MATERIALS AND METHOD

The research was conducted between October 2023 – May 2024 at the Academy of Zamość in Zamość, Poland, and Academy of Economics and Education in Lublin, Poland. The study involved 306 first- and second-level nursing students (stationary and part-time studies), of all years, who were pursuing courses at the CSM, which guaranteed adequate representativeness of the sample in terms of evaluation of educational practices and medical simulation assumptions. Participation in the study was voluntary and students were informed about the nature of the study and the rules of anonymity. The research project received a positive opinion from the Bioethics Committee at the Academy of Zamość (Approval No. KBAZ1/2024). The study was carried out by means of a diagnostic survey method, using the standardised research tool Educational Practices Questionnaire (EPQ), validated and culturally adapted to Polish conditions by Zalewska and Zarzycka published in 2022.

Statistical methods. Analysis of the data obtained was carried out with the help of Statistica 13.3. Counts, percentages and descriptive statistics (mean, standard deviation, median, first and third quartiles, minimum and maximum), as well as a bar chart, were used to characterise the study group and the EPQ results. In addition, the following statistical tests were used: the Spearman correlation coefficient, the Mann-Whitney U test and Kruskal-Wallis test. Non-parametric tests were chosen due to the strong left asymmetry of the distributions of the analysed variables. Moreover, the Lilliefors test also rejected the normality of the distribution of the characteristics under study. Spearman's correlation coefficient was used to analyse the relationship between age and ratings of educational practices, simulation assumptions and student satisfaction and confidence. The Whitney U-Mann test was used to compare the results of the EPQ standardised questionnaires according to education and having children, while the Kruskal-Wallis test was chosen for the variables place of residence and marital status. The analysis assumed a statistical significance level of $p<0.05$.

The reliability of the tool during validation was assessed using Cronbach's alpha coefficients – 0.90 for EPQ-PO and 0.93 for EPQ-IO, indicating very good internal consistency. This ensured that own research did not require additional assessment in this regard.

RESULTS

Characteristics of the students surveyed. A total of 306 nursing students aged between 20 – 50 years (M±SD = 30.57±8.12) participated in the study. The students surveyed most often lived in rural areas – 47.05%, were single – 51.96%, or married – 41.18%; percentage of respondents with children – 48.37% and without children – 51.63%. Socio-demographic characteristics of the student respondents are shown in Table 1.

Table 1. Characteristics of the students surveyed

Variables	M±SD	Me	Min-Max
Age	30.57±8.12	30.0	20–50
		N	%
Place of residence	rural	144	47.06
	small town	66	21.57
	large town	96	31.37
Marital status	single	159	51.96
	married	126	41.18
	divorced	21	6.86
Do you have children?	yes	148	48.37
	no	158	51.63

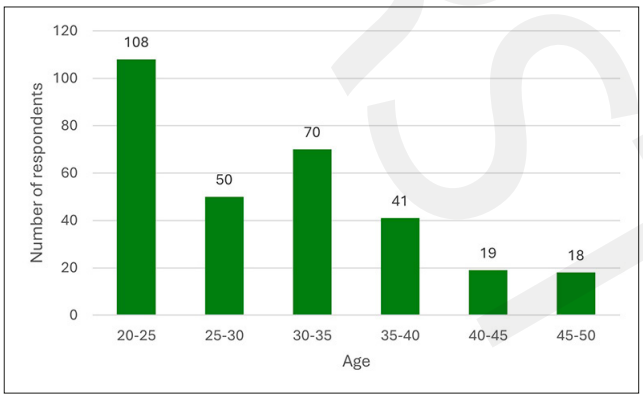

Figure 1. Age of students surveyed

Table 2. Overall evaluation of educational practices according to the EPQ questionnaire among the surveyed students

Scale	Evaluation of educational techniques					Importance of educational techniques				
	M	SD	Me	Q1	Q3	M	SD	Me	Q1	Q3
Active learning	4.2	0.7	4.3	3.9	4.7	4.4	0.4	4.5	4.1	4.8
Cooperation	4.6	0.5	5.0	4.0	5.0	4.5	0.6	4.8	4.0	5.0
Differentiated learning	4.3	0.7	4.0	4.0	5.0	4.4	0.7	4.5	4.0	5.0
Expectations	4.1	0.9	4.0	3.5	5.0	4.5	0.6	4.5	4.0	5.0
Total	4.2	0.6	4.4	3.9	4.7	4.4	0.4	4.4	4.0	4.9

Table 3. Evaluation of educational practices according to the EPQ questionnaire among surveyed students according to age

Scale	CORRELATION WITH AGE					
	Evaluation of educational techniques			Importance of educational techniques		
	R	t	p	R	t	p
Active learning	-0.137	-2.420	0.016	-0.001	-0.019	0.985
Cooperation	-0.100	-1.759	0.080	0.035	0.609	0.543
Differentiated learning	-0.036	-0.627	0.531	0.076	1.324	0.187
Expectations	-0.181	-3.205	0.001	-0.005	-0.081	0.935
Total	-0.141	-2.475	0.014	0.021	0.362	0.718

The majority of students were in the age range 20 – 25. Another large group was made up of students in the age range of 30–35 (Fig. 1).

The students surveyed rated the educational techniques in the area of cooperation the best (Me=5.0), while they rated the differentiated learning (Me=4.0) and expectations (Me=4.0) slightly lower. The area of collaboration was also the most important for the respondents (Me=4.8), while the results of the other scales were at a similar level (Tab. 2).

Evaluation of learning practices in relation to demographic characteristics. Statistical analysis showed a weak negative correlation between age and the evaluation of active learning (R=-0.137; p=0.016), expectations (R=-0.181; p=0.001) and overall evaluation of educational techniques (R=-0.141; p=0.014). This indicates that as age increases, the importance of these areas of education decreases. However, no significant relationship was found between age and the importance of educational techniques (Tab. 3).

Active learning (p=0.001), differentiated learning (p=0.012) and educational techniques in general (p=0.002) were by far the worst rated by students residing in large cities. In contrast, expectations were rated significantly better by rural residents (p=0.012). In addition, residents of large cities indicated a significantly lower importance of differentiated learning (p=0.014), and the importance of educational techniques in general (p=0.026) than others. Otherwise, there were no significant differences in the evaluation of educational practices among students according to place of residence (Tab. 4).

There were no statistically significant differences in the assessment of learning practices by nursing students according to marital status. However, it can be noted that divorced respondents rated the area of expectations slightly better, while differentiated learning modalities were of least importance for unmarried respondents. It should be noted that the 'divorced' distractor is unequal (n=21), which may affect the results and their interpretation, no less active learning in the sense of educational techniques (in the 'divorced' distractor) reached around statistical significance (p=0.089) (Tab. 5).

Students with children rated the area of expectations significantly worse (p=0.027). Otherwise, however, the evaluation of educational techniques did not differ significantly according to having children. Furthermore, there were no significant differences in the importance of educational techniques (Tab. 6).

Table 4. Evaluation of educational practices according to the EPQ questionnaire among surveyed students according to place of residence

Scale	EVALUATION OF EDUCATIONAL TECHNIQUES					IMPORTANCE OF EDUCATIONAL TECHNIQUES				
	village	small town	large city	Kruskal-Wallis test		village	small town	large city	Kruskal-Wallis test	
				H	p				H	p
Active learning	4.4 (4.0–4.8)	4.3 (4.0–4.8)	4.1 (3.6–4.5)	13.357	0.001	4.5 (4.0–4.9)	4.5 (4.1–5.0)	4.2 (4.1–4.8)	3.557	0.169
Cooperation	5.0 (4.0–5.0)	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.949	0.622	4.5 (4.0–5.0)	5.0 (4.0–5.0)	4.5 (4.0–5.0)	3.202	0.202
Differentiated learning	4.5 (4.0–5.0)	4.5 (4.0–5.0)	4.0 (3.5–5.0)	8.803	0.012	4.5 (4.0–5.0)	5.0 (4.0–5.0)	4.0 (3.5–5.0)	8.479	0.014
Expectations	4.5 (3.5–5.0)	4.0 (3.5–5.0)	4.0 (3.0–5.0)	8.888	0.012	5.0 (4.0–5.0)	5.0 (4.0–5.0)	4.5 (4.0–5.0)	3.980	0.137
Total	4.4 (4.0–4.8)	4.4 (4.0–4.8)	4.2 (3.6–4.5)	12.872	0.002	4.5 (4.1–4.9)	4.5 (4.1–4.9)	4.3 (4.0–4.8)	7.298	0.026

The median is given for each group (Q1–Q3)

Table 5. Evaluation of educational practices according to the EPQ questionnaire among surveyed students according to marital status

Scale	EVALUATION OF EDUCATIONAL TECHNIQUES					IMPORTANCE OF EDUCATIONAL TECHNIQUES				
	single	married	divorced	Kruskal-Wallis test		single	married	divorced	Kruskal-Wallis test	
				H	p				H	p
Active learning	4.3 (3.9–4.6)	4.3 (3.8–4.7)	4.2 (3.8–5.0)	0.235	0.889	4.5 (4.1–4.8)	4.4 (4.0–4.8)	4.5 (4.3–5.0)	4.844	0.089
Cooperation	5.0 (4.0–5.0)	5.0 (4.0–5.0)	5.0 (4.0–5.0)	1.419	0.491	5.0 (4.0–5.0)	4.5 (4.0–5.0)	5.0 (4.0–5.0)	1.452	0.484
Differentiated learning	4.0 (4.0–5.0)	4.0 (4.0–5.0)	4.0 (4.0–5.0)	0.171	0.918	4.5 (4.0–5.0)	4.8 (4.0–5.0)	5.0 (4.0–5.0)	2.442	0.295
Expectations	4.0 (3.5–5.0)	4.0 (3.0–5.0)	5.0 (3.5–5.0)	3.237	0.198	4.5 (4.0–5.0)	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.277	0.871
Total	4.4 (4.0–4.6)	4.4 (3.9–4.7)	4.5 (3.9–4.9)	0.522	0.770	4.4 (4.0–4.9)	4.4 (4.1–4.8)	4.6 (4.2–5.0)	2.284	0.319

The median is given for each group (Q1-Q3)

Table 6. Evaluation of educational practices according to the EPQ questionnaire among surveyed students according to having children

Scale	EVALUATION OF EDUCATIONAL TECHNIQUES				IMPORTANCE OF EDUCATIONAL TECHNIQUES			
	with children	no children	Mann-Whitney U test		with children	no children	Mann-Whitney U test	
			Z	p			Z	p
Active learning	4.2 (3.8–4.6)	4.3 (4.0–4.7)	-1.525	0.127	4.5 (4.1–4.9)	4.5 (4.0–4.8)	0.209	0.834
Cooperation	5.0 (4.0–5.0)	5.0 (4.5–5.0)	-1.442	0.149	4.8 (4.0–5.0)	4.8 (4.0–5.0)	0.220	0.826
Differentiated learning	4.0 (4.0–5.0)	4.3 (4.0–5.0)	-0.354	0.724	4.5 (4.0–5.0)	4.5 (4.0–5.0)	0.507	0.612
Expectations	4.0 (3.0–5.0)	4.5 (4.0–5.0)	-2.215	0.027	5.0 (4.0–5.0)	4.5 (4.0–5.0)	-0.436	0.663
Total	4.3 (3.8–4.6)	4.4 (4.0–4.7)	-1.575	0.115	4.4 (4.0–4.9)	4.4 (4.0–4.9)	0.146	0.884

The median is given for each group (Q1–Q3)

DISCUSSION

An available systematic review of educational effectiveness has shown that interprofessional education is important in the acquisition of key practical skills of future medical Staff [6]. The analysis and review of existing studies showed that the assessment of the impact of socio-demographic characteristics on the effectiveness of educational practices in the medical simulation method, has not been widely studied [10]. However, there are factors that significantly influence the effectiveness and motivation to undertake further education [11]. A similar trend and the need to explore the impact of socio-demographic and cultural characteristics on the quality of education was noted in a systematic review conducted on the effectiveness of simulation-based interprofessional education [5].

The extant literature on the EPQ instrument offers limited opportunities to compare results with other studies in terms of the impact of the afore-mentioned characteristics on assessment results. The limited number of literature references is due to the lack of previous studies directly addressing this topic, which highlights the originality of the present study and its relevance for further research in the field. A strong correlation was noted when differentiating assessment by students' place of residence. The aspects of active learning (p=0.001), differentiated learning modalities (p=0.012) and educational techniques in general (p=0.002) were the most significant in this respect, and were rated by far the lowest in the assessment of residents of large cities. Expectations regarding the effectiveness of medical simulation were rated significantly better by rural residents (p=0.012).

In the available literature, there is a lack of detailed research on the impact of socio-demographic variables on the evaluation of medical simulation educational practices, which has been identified as a research gap (white gap), i.e. an area that has not yet been sufficiently investigated, or where clear results and answers to relevant research questions are lacking. In the case of the influence of socio-demographic characteristics on the evaluation of the effectiveness of medical simulation, the research gap is due to the fact that most of the available literature focuses on the validation of measurement tools and the cultural adaptation of questionnaires, rather than on the analysis of the influence of variables such as age, place of residence or family status on the perception of the effectiveness of simulation education. Identifying the research gap helps to justify the need for new research and to highlight its importance for developing knowledge in the field. The evaluation of educational techniques and their importance was at a high level in the study group (Tab. 2).

Comparable results were obtained for the 2019 study conducted at the two academic centres – Zamość and Lublin – which showed that socio-demographic variables, including gender and place of residence, significantly differentiated the scores of the EPQ scales and subscales. The largest significant differences were achieved in the cooperation scale in relation to year of study (p=0.049). No statistically significant differences were obtained in the other variables analysed [12]. The results obtained in the 2019 study corroborate the results of own study, in which the collaboration scale was also rated highest, with socio-demographic variables showing no significant effect on this rating. A study of a cultural adaptation of the EPQ questionnaire conducted on 626 nursing students in Spain yielded similar results, with the scale on cooperation rated highly. Demographic characteristics other than the age of the students, were not taken into account in the above studies [13]. The EPQ questionnaire was also used to assess the effectiveness of simulation in a study conducted among 87 nursing students in Turkey [14]. In a study conducted among 105 students at a Norwegian university, the results indicated a strong correlation of scores on the 'cooperation' scale [10]. Both studies indicated that the validation of the tool was successful and that the questionnaire can be successfully used for studies with larger samples, taking into account additional factors that determine the impact on scale scores. Analogous results were achieved in a study conducted at the University of Hong Kong. Validation and adaptation showed that among the 300 questionnaires qualified for analysis, the highest significance related to place of residence was obtained with the 'cooperation' scale [15].

The impact of socio-demographic characteristics on the effectiveness of medical simulation for COVID-19 pandemic was investigated in 2019 – 2020 among 118 nursing students at Hafr Al Batin University in Saudi Arabia. Similar to the studies cited above, the highest scores were achieved on the 'cooperation' (3.36 ±1.22) and 'expectations' (3.33±1.22) scales. Furthermore, similar to the current own study, demographic data such as age (p=0.847) or marital status (p=0.656) showed no statistically significant differences in the evaluation of the training method [16]. The results obtained among 461 Saudi Arabian students are in contrast to the current study. Analysis of the EPQ questionnaire of that study revealed significant differences in assessment scores in correlation with gender (p=0.01). The study among Saudi students found that there were more females (56.8%) than males (43.2%) in the sample, reflecting general demographic structures in nursing [17].

Despite the lack of variable analyses in other articles, it is noteworthy that in the current study, the weak negative

correlation between age and ratings of active learning (R=-0.137; p=0.016), expectations (R=-0.181; p=0.001) and overall ratings of educational techniques (R=-0.141; p=0.014), warrants the conclusion that as age increases, the importance of these areas of education decreases. On the other hand, socio-demographic characteristics also indirectly influence the effectiveness of education in the form of perceived stress related to education in medical professions and subsequent choice of specialisation. In a study conducted on a group of 459 students of different years of two medical schools – the Sultan Qaboos University and the National University – in Oman, the influence of socio-demographic factors, such as gender, place of residence, marital status or having children on the choice of educational path in the course of study, was analysed. The respondents were overwhelmingly childless (98.7%) single (94.3%) and from urban areas (67.6%). A statistically significant difference was observed in relation to the gender variable for the choice of specialisation. Men show a higher propensity to train in surgical procedures (p=0.003) and mastering their specialty (p=0.008) [18]. The study of 377 nursing students clearly demonstrated that characteristics such as gender, age, marital status, country of birth, residential status and language spoken (60% of the study group were international students) indirectly influence the evaluation of the effectiveness of training expressed in terms of the level of stress experienced, which is reflected in the results. Student performance was additionally lower among those who migrated for educational purposes, were without family or support networks [19]. In another study conducted at Nantong University in China, it was shown that those who received support from their family and environment were significantly better at evaluating the learning process, and the effectiveness of education was higher. At the same time, they experienced lower levels of stress and self-doubt [20].

Studies of the influence of socio-demographic factors on the effectiveness of medical simulation education were also conducted in a randomised trial using VR (virtual reality). The implementation of this type of simulation among 132 final-year students at the Faculty of Medicine in Madrid showed that age and gender significantly influenced positive perceptions of VR use, and the effectiveness of simulation-based education (p=0.008). The influence of marital status on the evaluation of training was not confirmed by the results (p=0.743) [2].

CONCLUSIONS

Medical simulation as an educational method is positively evaluated among nursing students, regardless of the presence of socio-demographic characteristics. The presented study shows a general relationship of the influence of selected socio-demographic characteristics on the evaluation of educational practices in medical simulation. Despite the occurrence of a relationship, the age of the respondents did not determine the outcome of the evaluation of simulation effectiveness. A similar situation occurred in the assessment of the influence of marital status on educational effectiveness – a strong correlation was noted when the evaluation was differentiated by the place of residence of the students. The aspects of active learning (p=0.001), differentiated learning modalities (p=0.012) and educational techniques in general (p=0.002) were the most significant in this respect, and were rated by far the lowest in the assessment of residents of large cities. Expectations regarding the effectiveness of medical simulation were rated significantly better by rural residents (p=0.012).

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