



Comparative Millennial and Z Generation Endoscopic Surgical Skills

José Luis Mosso Vázquez*, Renata Moreno Cordero, Paula Loyola Nieto, Alberto Moscona Nissan, Megan Barragan Wolff, Eduardo Brenner Muslera and Andrea Campos Díaz

School of Medicine, Universidad Panamericana, Mexico City, Mexico

*Corresponding Author: José Luis Mosso Vázquez, School of Medicine, Universidad Panamericana, Mexico City, Mexico.

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Abstract

Introduction: Having been raised in contrasting backgrounds, Generation Z has developed surrounded by the internet, social media, artificial intelligence, and video games as opposed to Millennial. This augmented exposure could provide an advantage for Generation Z individuals over Millennial in the development of finer laparoscopic surgical skills when comparing both groups' performance.

Aim of the Study: The aim of this study is to demonstrate that Generation Z students surpass Millennial in performing laparoscopic surgical tasks.

Methods: Two comparative groups participated, 43 Millennial and 41 Generation Z students, respectively. A laparoscopic surgical task was completed by each student with the time taken to complete the task measured in seconds. The data obtained were analyzed using representative statistics, such as mean \bar{x} , standard deviation (σ), and maximum and minimum time. Chi-Square test analysis was chosen as the statistical method to compare surgical skills between groups. Mobile phones were integrated into Endoscopic surgical simulators and used as laparoscopes after being connected to a computing device.

Results: Generation Z performed the laparoscopic surgical task with the following results: χ^2 (Chi-square test) 10.86 and α (alpha) = 0.01, and a mean time of 107.40 seconds. Meanwhile, millennial students completed the task in a mean time of 146.09 seconds.

Conclusion: Generation Z's higher performance could possibly be explained by their precocious exposure to technological advances. Overall, technology has provided teenagers with skills such as increased hand-eye coordination and visuo spatial cognitive abilities that could potentially be of use in medical education, specifically benefitting surgical dexterity and facility within the field.

Keywords: Millennial; Generation Z; Laparoscopy

Introduction

A generation is understood as a category of people that share a range of birth dates, historic events lived, and life experiences that result in individuals with similar attributes, views of authority, values and expectations. The most prevalent generations among the population include Baby Boomers (born between 1946 - 1964), Generation X (born between 1965-1979), Millennials (born between 1980 - 1995), Generation Z (born between 1996 - 2012),

and the not fully recognized Generation Alpha (born after 2012). Each generation has distinctive attributes that differentiate them from other cohorts. Some qualities that have been attributed to the Millennials are optimism, self-confidence, understanding of technology, and tendency to collaborate, while Generation Z is thought to be even more technologically advanced, pragmatic, financially stable, and individualistic than their millennial peers [1-3].

In fact, it is expected that Generation Z medical students will not only prefer conventional learning, but also using electronic devices and other methods that don't include face-to-face interaction [4]. On the other hand, it has been mentioned that, although Millennials think that Surgery is an interesting field, they might not be as committed as prior generations to pursue a career in it [5]. Currently, minimally invasive surgery (MIS) procedures such as laparoscopy have become widely used worldwide. Laparoscopic procedures rely on the creation of a "workspace" generated by the introduction of gas into the abdominal cavity and using small incisions to access the abdomen with a camera and multiple tools that allow the surgeon to visualize the area and carry out the surgery. Advantages offered by laparoscopy include better cosmetic results, faster recovery, and most importantly: less morbidity and mortality [6]. The da Vinci Surgical System was implemented for coronary artery bypass grafting in 1999, marking an exponential increase in the use of this technique in diverse surgical subspecialties, such as urology and gynecology [7]. Although the laparoscopic approach shows several benefits against conventional surgery. It implies some downsides for surgeons and students, such as two-dimensional visualization, a reduced surgical field and limitation of mobility range, the loss of tactile sensation, and the challenge of having proper control of equipment that is fixed to a point in the abdominal wall [8]. Therefore, laparoscopic surgery requires higher visual-spatial skills, depth-perception skills, and hand-eye coordination [9]. This exigency makes the need for adequate teaching techniques and assessment of laparoscopic skills more evident [10]. Even with current teaching strategies, some beginners lack the technical skills and confidence to perform MIS, so the employment of simulators has shown to be an appropriate method for training future surgeons without putting patients at risk by allowing them to practice and favoring the reduction of the learning curves in an environment that is safe and controlled. This learning technique also enables the instructors to give proper feedback to their students [11]. Studies have demonstrated that even high school and undergraduate students are capable of acquiring laparoscopic dexterity through simulator practice [12]. In fact, polls show that, in general, students display high interest in surgical specialties [13] and Grover, *et al.* noted that medical students exposed to didactic presentations and surgical workshops were more likely to pursue surgery as a career later on [14]. It is also important to mention that, even though beginners train several hours, there is still a lack of time and a shortening of training opportunities to acquire the skills previously mentioned, because of that, it has been proposed

that residents can train by other methods during their free time [15,16]. Along this line of thought, some studies have linked the use of video games to the development of laparoscopic skills, since both games and laparoscopy demand eye-hand coordination and visuospatial cognitive ability. Consequently, the newer generations of students may be keener on these procedures as they have more gaming experience than the previous generations and people who usually don't play video games [17-19]. "Serious gaming" or "Gamification" is defined as the utilization of game design elements in a nongame context in order to present information to learners. It has been proposed as an easier and more affordable method for these students, making learning more attractive and associated with gratification [20,21]. Admittedly, the different attributes between current and upcoming generations highlight the need for education programs and methods that are directed at each generation's weak and strong qualities, in order to potentiate their abilities and strengths [22,23]. Universidad Panamericana in Mexico City has been the top Mexican medical school for the last 14 years. A basic course in open surgery (two semesters), an endoscopic surgery program (one month) and an introduction to robotic surgery (a week) give students an approach to surgery and allows them to develop surgical skills for open and laparoscopic surgery. Students interested in surgery can use the robotic surgery simulator in the Medical Center. On the other hand, high school students participate in a basic course of 8 hours that consists of basic surgical theory and training with laparoscopic surgical simulators, where mobile phones are the main tool used as laparoscopes in endoscopic surgery. The main goal of said course is to offer high school students an introduction to surgery and increase their interest in pursuing a medical career.

Methodology

A total of 84 students were divided according to their age into two comparative groups of Millennial ($n = 43$) and Generation Z students ($n = 41$). The Millennial group consisted of medical students from Universidad Panamericana and members of the Z generation are high school students in Mexico City. The mean age of the Millennial and the Z Generation group is 20.09 and 17.39 years, respectively. Females represent 47% of the millennial group while males represent 53%. Meanwhile, in Z Generation, females constitute 75% and males 25% of the group. Mobiles were used as laparoscopes in the endoscopic surgery simulator and the task to be performed by both groups was to move 3 items from one place to another. Students handled the items with the right hand and then

transferred them to the left hand using real laparoscopic tools, after that, the three items were placed in a small case. The time to complete the task was measured in seconds. Chi-Square was the statistical method used to demonstrate our alternative hypothesis, where younger students (Z generation) have more eye-hand coordination than the Millennial generation. JASP (a statistics program) was used to generate the statistical description. Data information was registered in a Microsoft Excel database which included the following categories: Name of the participants, generation, date of testing, previous history of video game use, school (high school or medical school), and the time it took to perform the task.

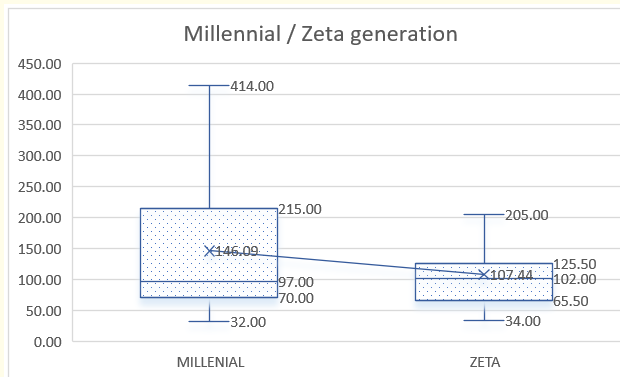
Finally, the program calculated the mean, maximum, minimum, standard deviation, and generated the tables and boxplots that describe how much time it took the participants to perform the task according to their generation.

Results

Both χ^2 (Chi-square) = 10.86 and α (alpha) = 0.01, demonstrate that generation Z students were faster to move 3 items using laparoscopic tools. Z generation mean time was 107.4 seconds. Meanwhile, Millennial completed the task in 146.09 seconds. The mean time of the Z generation (High School students) is shorter than the one from the Millennial generation (Medicine students) as we represent $\bar{x} = 107.4 < \bar{x} = 139.9$. The standard deviation shows a reduction rank closer to the mean time in Z generation. $\sigma = 60.78 < \sigma = 107.44$ and σ demonstrate an important difference between the millennial and Z generation's time to perform a specific surgical task (Table 1). In graph 1, there are Boxplots for both generations that show the differences between mean time, maximum and minimum in both groups.

	Millennial generation (Medicine Students) 20.09 average age	Z generation (High School Students) 17.39 average age
	43	41
Minimum	32	34
Maximum	414	339
\bar{x}	146	107.4
σ	104.25	60.78
χ^2	10.86	
α	0.01	

Table 1: Comparative time in seconds for the same laparoscopic surgical task between Millennial (medical school) and Z Generation (High school students).



Graph 1: Comparative boxplots surgical time between Millennial and Z generations.

Discussion and Conclusion

Internet, social media, artificial intelligence, machine learning, networks, deep learning, video games, the internet of things, and robotics are some examples of new technologies that new generations interact with. Skills developed around these technologies give teenagers potential elements to perform surgical tasks with ease, and it provides the opportunity to study Medicine or an engineering career such as computer science.

In this sample, Z Generation exhibited more skills for endoscopic surgery than the millennial generation. Z Generation's background is highly influenced by current breakthroughs, which are characterized by quick evolution and change; this may facilitate said generation acquisition of new skills and abilities.

Generation Alpha is expected to have even more skills due to the technological evolution taking place every 6 months, or even faster. Deep learning is the top technology in computer science nowadays and its development will give rise to new areas of artificial intelligence that will impact the lifestyle of young people and the next generations.

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