Visuality: a crossroad
between humanities and technologies

a cura di
Gualtiero Volpe

GENOVA UNIVERSITY PRESS

Visualità

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VISUALITY AND TECHNOLOGIES FOR EDUCATION

10. The use of simulation as a training method in the pharmaceutical field. Comparison between face-to-face scenarios and virtual scenarios

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10.1 Introduction

For several years, the areas of competence of pharmaceutical services have evolved towards what is called the Pharmacy of services. The pharmacy extends its skills and activities beyond the mere supply of medicines, providing services related to the national health system (booking visits, payment of hospital tickets, collection of reports) and providing a contribution in primary care and monitoring of citizens' health (from vaccinations to monitoring parameters such as blood sugar and blood pressure). This implies a greater and varied exposure of pharmacists to situations that require solid skills both on a technical and relational level, in the management of relations with users. Consequently, the training courses must adapt to these new challenges to enrich the pharmacist's skills profile. A method widely used in training courses in the health sector is simulation, both the so-called 'high fidelity' (faithful reproduction of the operational contexts typical of the profession in which typical situations are reproduced) and relational simulation (reproduction of situations of a relational nature in which the operator must interact with a user/patient).

This research aims to investigate the effectiveness of simulation as a training method of knowledge and competences, both of a technical nature (skills and knowledge specific to the professional context), and of a non-technical nature (relational skills, decision-making

skills, etc.), in the context of the Farmacia dei Servizi. Specifically, we wanted to investigate the educational effectiveness of two simulation approaches, one that provides for the realization in the presence of simulated scenarios, the other that is based on the realization of these scenarios on a digital platform, usable in asynchronous and autonomous mode by students.

10.2 State of the art

Simulation has been defined as an effective method for teaching and developing skills regarding interprofessional communication and clinical judgment, which also contributes to creating self-confidence in the learner (Lasater, Nielsen, 2009; Kolbe, Grande, Spahn, 2015). From the point of view of personal growth, in fact, it stimulates students to learn from each other and to gain greater self-confidence, developing their ability to evaluate themselves (Titzer, Wenty, Hoehn, 2012). It provides them with opportunities for interprofessional collaboration, thus determining the improvement of the understanding of the roles of the different disciplines and the achievement of problem solving skills (King, Conrad, Ahmed, 2013).

In the healthcare field, the simulation will not be able to fully replace the care experiences aimed at the patient in a real clinical context, but it will still be able to provide a care approach comparable to the real one, with the advantage of being carried out in a controlled environment, this allows students to make mistakes, without them entailing consequences (Kelly, Hager, Gallagher, 2014; Sponton, Iadeluca, 2014). Specifically in the pharmaceutical field, simulation could instead be a valid substitute from the point of view of the exercise of relational skills since they have become a significant quality of the health role only recently. It is relatively a short time ago that health communication ceased to be considered 'unnecessary bedside manners' (Jackson and Duffy, 1998), therefore 'useless mawkishness to do at the bedside', and gradually evolved into an effective tool for the delivery of health care and in the promotion of the same. A funda-

mental component of being a 'good' pharmacist should be his strong empathic capacity, a characteristic often underestimated, but which requires the same practice as a technical skill. In addition, in recent years, the tasks that belong to the profession of pharmacist have been expanded with the establishment of the Pharmacy of services, consequently the simulation method should be used and implemented further also for this branch of medicine, from a point of view of the growth of both relational and technical skills.

In the '90s the academic reality of Pharmacy began to adapt to the need for better communication skills by professionals in the field; in 1997 both the World Health Organization and the International Pharmaceutical Federation published reports outlining communication skills as essential to pharmacy practice (Wallman, Vaudan and Sporrong, 2013). In America, numerous schools in the sector have established a basic communication course, with particular attention to individual communication and, in the last decade, role-playing games and simulations have also been introduced, to make the learning of relational skills more effective (Adrian, Zeszotarski and Ma, 2015).

The simulations designed based on the achievement of specific learning objectives offer the opportunity to go through the phases of the experiential cycle by merging the active component with the subsequent analysis and reflection on the experience, reaching the facilitation of study through practice as a fundamental result. Experiential Learning is therefore particularly convenient for orientation to professional practice, in which the integration between theory and application is continuous (Schunk and Zimmerman, 1998). A standardized patient can be defined as someone who has been trained to portray a character or problem according to the script of a constructed scenario, which provides a coherent and similar performance to different students. The experience exposes trainees in training to clinical scenarios within a safe and predictable learning environment. Standardized patients could also evaluate or provide feedback on students' performance, based on their experience gained in various interpretations as actor-patients.

The design of a simulated scenario can be divided into three fundamental phases for a correct realization: the *pre-briefing* or *briefing*, the simulated interaction and the debriefing. This last phase is the most important, since, if conducted correctly by the debriefer, it allows students to achieve the set educational objectives. The debriefing is the fundamental moment because it favors the reflection of the participants with respect to the actions carried out or observed during the simulation. The reflection on one's own behaviors (and on the underlying mental elaborations) or on those observed in one's colleagues engaged in simulation, allows to stimulate metacognition processes, that is, the reflection on one's own mental processes, learning to know them and manage them in a strategic way.

Given the centrality of debriefing, the research question turned to the study of two simulation models in which this phase is managed in radically different ways: simulation in presence and that on a digital platform in asynchronous mode. The first, in presence, is inspired by the widely established simulation tradition in the field of training in the health professions. The second form, on a digital platform, is less explored and deserves careful evaluation for its limits (poor control of the reflective processes of the learner) and its opportunities (possibility of asynchronous use, for large numbers, even remotely).

The live simulation scenario involved the setting up of a fake pharmacy inside a university classroom, while the virtual simulation involved the design of a *Branching Scenario* with the H5P software. In fact, it consists of an interactive narrative in which the participant is invited to make decisions at certain nodal points of the scenario. Based on his choices, the system provides feedback on the correctness of the choices. The virtual scenario was designed considering the impossibility of carrying out the *debriefing* as it happens in the condition in presence, this phase was replaced by immediate feedback that was returned by the software immediately after the choices that the student made during the interaction. Table 1 describes the main strengths and weaknesses of the two approaches.

	Strengths	Weaknesses
Face-to-face simulation	Greater realism Flexibility in narrative dynamics *Debriefing* managed by the teacher and calibrated on the specific situation	Commitment of spatial, temporal and economic resources Active participation of a few students for each scenario
Simulation on digital platform	Less resource effort Ease of use No limits to participants and repetitions of simulations Standardization of simulated situations	Less realism Rigidity of narrative dynamics *Absent debriefing*

Table 1: Comparison between real and virtual simulation: strengths and weaknesses.

The comparison of the results of the questionnaires administered to the students, after the simulation and the debriefing, was fundamental to understand if the online simulation could allow the achievement of the educational objectives, like the simulation in presence. If the training objectives have been sufficiently achieved with both types of simulation, this research can lay the starting points to start proposing and developing a greater introduction of this innovative teaching method in the courses of study in Pharmacy. Since this type of simulation, as has been demonstrated and explained, requires a lower use of economic resources, resources in terms of time and availability of people.

10.3 Material and method

The research followed a design for independent groups: the experimental group performed the scenario in digital mode and the control group performed it in face-to-face mode. The independent variable is the type of simulation (in presence *vs.* on asynchronous digital platform) and the dependent variables are the participants' experience with respect to the method and their learning of the key notions for that type of scenario.

10.3.1 Face-to-face simulation

The condition of simulation in presence has provided for the definition of these three aspects:

1. The scenario sheet: it consists of the detailed description of the learning objectives, the context to be simulated, the behavior track that the simulated patient will have to follow. The type of situation represented concerns the measurement of a patient's blood pressure.
2. Preparation of the simulation setting: it is a reproduction of an area of the pharmacy where the services requested by the patient will have to be provided.
3. The observation card with the behavioral indicators: created by the debriefer to focus on the two fundamental aspects of the final purpose of the simulation in the pharmaceutical field: the student's behavior towards the actor-client and the management of the task, in this case the measurement of pressure.
4. *At the end of the simulation, students were given the 'Student Satisfaction and Self-Confidence in Learning' questionnaire consisting of 16 questions divided into areas: 5 concerning satisfaction with current learning, 8 concerning confidence in their own learning and finally, 3 questions to verify the actual learning of the concepts encountered during the simulation (Pence, 2022).*

To verify the learning of notions related to the scenario presented (*e.g.* the procedure for the safe management of the patient) a quiz was administered with three multiple choice questions.

10.3.2 Simulation on virtual platform

H5P is a framework to support the development of interactive content in HTML5 that is easy to apply in education and teaching. The software offers the development of numerous digital contents such as interactive videos, course presentations, interactive games and much more.

It was decided to use the *Branching Scenario,* this content allows you to create adaptive paths structured in a tree, in which a scoring system is used.

The script that had been built to define the subject of the simulation, here took on a fundamental role for the design of the interaction, as each sentence used had been agreed and written together with a pharmacist by profession.

As for the interface design, different types of virtual interactions were used to create the interactive video:

- for the introduction, instructions, dialogues and conclusion: *course presentation* allows you to create slides containing images and text;
- for questions and answers: *branching question* allows you to create pop-ups that appear on the previous dialogue and ask the question to the student.

In this type of simulation, the debriefing phase in presence was replaced by the feedback that the system returned after the student's response.

A fundamental element of the design of all simulations in general is the identification of the target you want to hit. To define the characteristics of the profiles of our users, we must go and create *Personas*. The online simulation was addressed and designed for a single ideal *Personas*, namely that of the 'typical student of Pharmacy', for this reason it was necessary to take into account several aspects and various levels of skills and knowledge.

For the evaluation of the user experience of the experimental sample, the questionnaire '*Student Satisfaction and Self-Confidence in Learning*' was used, as in the control group (Pence, 2022), in its version with three additional items, aimed at verifying the learning experience in a virtual environment. This group also answered the questions for the learning assessment, using the same quiz given to the control group.

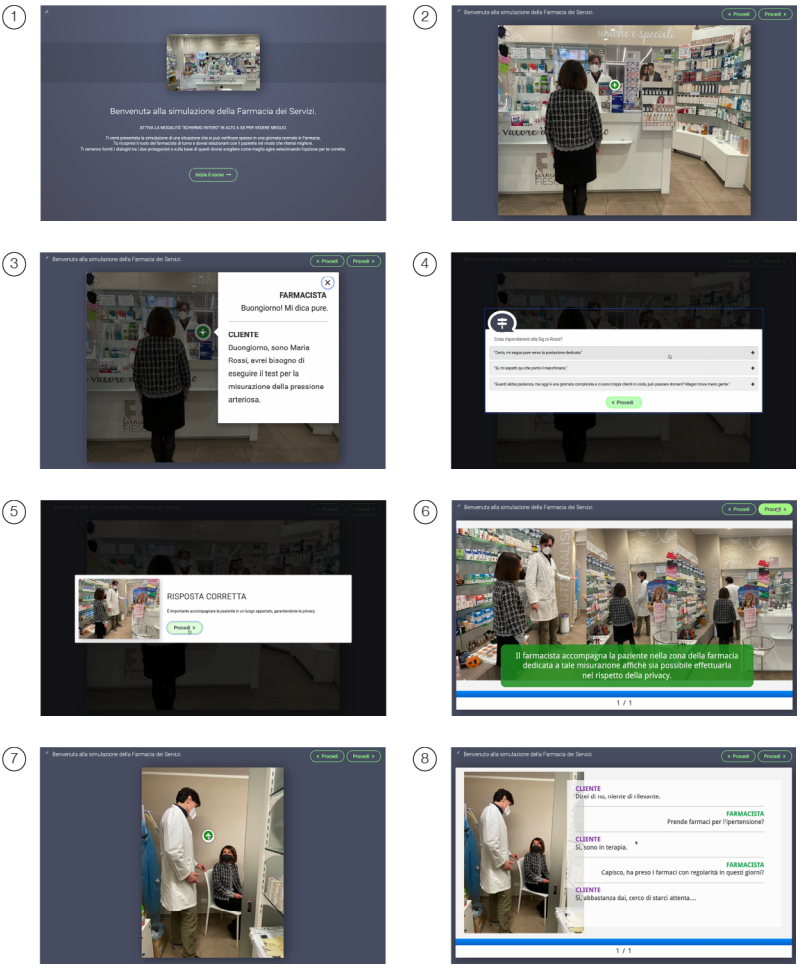


Fig. 1 Storyboard: graphical interface and sequence of the main steps of the virtual simulation created with the H5P framework.

10.4 Procedure

The first part of the research sees as protagonists the students of the 4th year of Pharmacy of Genoa, between 23 and 25 years of age, of both genders, who had previously been informed that in that lesson they would participate in a simulation.

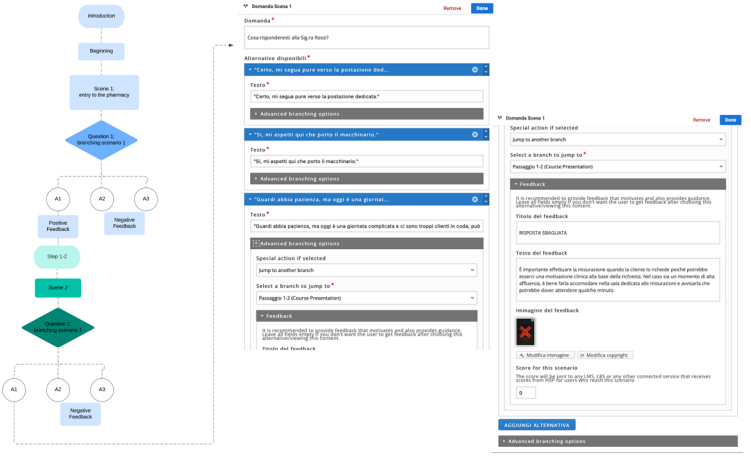


Fig. 2 Flowchart: example of structured branching extract in the back-end of H5P for building the Branching Scenario; example of filling in the form necessary for the pop-up containing the question to be asked to the student with the respective positive or negative feedback in relation to the correctness or otherwise of the answer.

In the first moment of the simulation, that of the *briefing*, the 19 students were explained how the simulation would take place and they were asked to express any doubts or questions regarding the course. They were introduced to the actor they would meet within the simulation, namely a pharmacist by profession, who had made himself available to play the role of the customer who showed up at the pharmacy to have his blood pressure measured. Obviously, the pharmacist had been trained to give certain answers and to bring the student to achieve precise training objectives. Subsequently, the students were asked who wanted to play the role of pharmacist within the scenario, and a volunteer was chosen who followed our standardized patient in the room where a pharmacy had been set up and in which the interaction took place. The topic and dynamics of the tested scenario had to be new and unknown to the students, to avoid that they could be

influenced and that is why the student who actually carried out the simulation was only one.

The colleague's performance was seen live by fellow students, who remained seated in the classroom, through a video projected on a screen in synchronous mode. After the interaction, the volunteer returned to his companions and the *debriefer* began the *debriefing*.

Before finishing the entire simulation process, the students were asked to answer an online questionnaire, previously prepared, which focused on the analysis of the two aspects just tested with the simulation: that of the student's satisfaction with the simulation he had just witnessed / participated in and that of confidence in their learning. In the final part of the questionnaire, they were asked three questions to verify the actual learning from the didactic point of view of what they had seen. They were not given a test before the simulation to outline the characteristics of the *Personas* who were participating because, with the correct performance of the *debriefing* phase, the levels of preparation and skills of all the students would be leveled.

The second part of the research saw a different sample as the protagonist, the simulation was in fact tested by 11 students of the 5th year of Pharmacy of the University of Genoa, aged between 24 and 26, of both genders. The methodology of use of the simulation, in line with its design, was necessarily different: the students were sent an email containing instructions to access the simulation through AulaWeb. This portal was chosen to facilitate the student, since from a didactic point of view, it is the one used by the University and provided the possibility to create the page of a course exclusively dedicated to the development of the entire simulation, thanks also to the implementation through the loading of the *Branching Scenario* built with the H5P software, allowing him to move within an environment already known to him. To complete the simulation correctly, a mode was activated on the course page

that allowed students to carry out the different steps as long as they had completed the previous one. Before the actual simulation, students were asked to fill out a questionnaire that investigated their personal experiences and propensities, both from the point of view of relational skills and from the point of view of the relationship with technology. After the use of the simulated scenario in H5P, a questionnaire was administered equal to that of the simulation in presence, but with added questions to investigate the student's point of view on the type of simulation.

10.5 Results

Below are the graphs of responses divided into categories:

- satisfaction with current learning;
- confidence in your learning;
- learning Assessment.

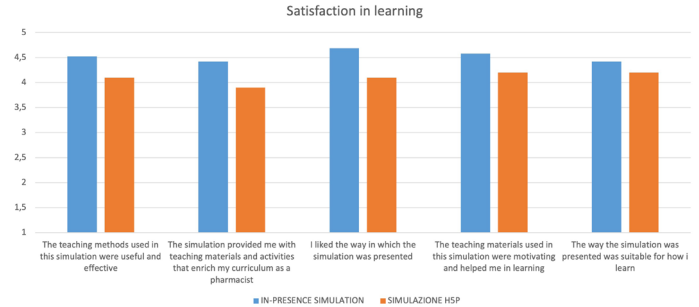
Questions regarding the methods and tools used during the simulation.

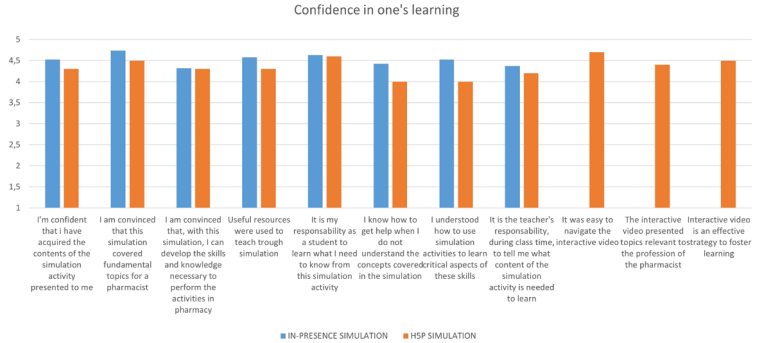
Comparing the answers obtained from the questionnaires, we can consider them positive overall. However, there were two conflicting opinions: one regarding face-to-face simulation on which a student found himself «strongly disagreeing on the usefulness and effectiveness of the teaching methods used» and one that indicated that the «way in which the online simulation was presented» was not particularly appreciated.

Questions regarding self-assessment and the learning process.

Also from the analysis and comparison of these results, we can be satisfied with the positivity of the answers. In particular, the results of the online simulation questionnaires revealed an indecision on the opinion to be expressed in the face of the ability to get help when they did not understand the concepts and on how to use the simulation to consolidate knowledge.

Questions regarding the skills that had to be achieved by the students from a didactic and formative point of view.





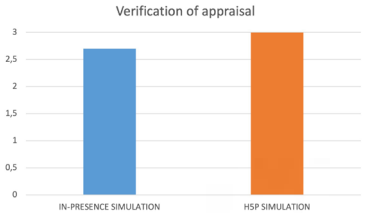


Fig. 3 User (student) questionnaire outcomes in relation to the methods and tools used during the simulation: learning satisfaction.

Fig. 4 User (student) questionnaire outcomes in relation to self-assessment and the learning process undertaken: confidence in one's own learning.

Fig. 5 User (students) questionnaire outcomes in relation to knowledge and skills acquired through simulation.

Taking into account the numerical difference of the components of the two samples of students and considering the overall results obtained on the learning of didactic knowledge to be very positive,

it emerges that the results of this final part of the questionnaire have reached the maximum of the desired result only in the answers of the online simulation questionnaires. Students who participated in the face-to-face simulation scored an average of 2.7 (90%) correctness on the three correct answers, while all students who tested the virtual simulation achieved the best performance with 100% of the right answers to the same three questions.

A descriptive and qualitative analysis of these scores showed slightly higher values on the appreciation of the experience of the simulation in presence, but the difference is not to be considered particularly significant. From the items on which a greater difference in score was found in the evaluations of the two samples, it emerged the difficulty encountered by the students who tested the H5P simulation in understanding where to receive help from the system and in addressing the critical issues of the required skills.

On the other hand, particularly positive results were obtained in the scores of the three additional questions of the online simulation questionnaire, which reported votes from 4 upwards, therefore more than encouraging. A further element in favor of the virtual simulation were the answers obtained to the questions of the 'learning verification', the online option achieved the best performance with 100% of the right answers, against 90% of the simulation in presence, a score however particularly high.

10.6 Conclusions

With this simulation experiment, the usefulness of the two different types, that of simulation in presence compared to the virtual one, in the pharmaceutical field was compared; the effectiveness was evaluated in terms of user experience from the point of view of learning. To do this, an interaction between a pharmacist and a hypertensive customer who went to the pharmacy to have his blood pressure measured was simulated. To design both scenarios, the same script was used, previously agreed with pharmaceutical professionals to en-

sure that it was as realistic as possible. The objective of our analysis was to verify if the two types of experience were comparable from the point of view of didactic usefulness and behavioral growth, since it is clear that the preparation of a simulation in presence requires a greater use of economic resources, time and personnel by the University. It has thus been shown that virtual simulation leads students to achieve the same set objectives, so it is to be considered that starting to develop simulations with this innovative type, could be convenient both for the University, for the reasons previously mentioned, and for the student, who could use it at any time.

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Collana ***Visualità***

1. *Storie di visualità*, a cura del Comitato di Gestione del Centro Interdipartimentale sulla visualità (E. Bistagnino, E. Bricco, F. Bracco, A. Di Biagio, G. Volpe), 2021; e-ISBN (pdf) 978-88-3618-069-1.
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Gualtiero Volpe is an Associate Professor at the Department of Computer Science, Bioengineering, Robotics, and Systems Engineering (DIBRIS) of University of Genoa, Italy. His research interests include intelligent and affective human-machine interaction, social signal processing, sound and music computing, analysis and modeling of expressive content, and multimodal systems. A key aspect of his work consists of taking inspiration from arts and humanities for designing multisensory technologies.

Since a few decades, we witness an increasing interaction between humanities and technology. Such interaction has led to maturing the awareness of how a synergy between these areas of knowledge can bring a significant progress in both fields. Visuality research can benefit in a special way from such a contamination of knowledge. This book consists of a selection of contributions taken from those presented in occasion of the 2nd Seminal Day of the Interdepartmental Center on Visuality (ciVIS) of University of Genoa, Italy. The event was held in February 2022 and was specifically dedicated to the interactions between humanities and technology in visuality research. Contributions span theoretical, foundational, and methodological aspects as well as provide examples of real-world applications.

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