

## CASE REPORT

# New innovative peripheral insertion method of IV cannula

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## ABSTRACT

**Objective:** Effective practice is increasingly seen as a critical dimension of the professional development of healthcare professionals. Reducing the number of punctures when placing an intravenous (IV) cannula reduces pain and further suffering for the patient. At the same time, the proper technique of IV cannulas save time for healthcare providers.

**Background:** The method of securing venous access by intravenous cannula is part of the teaching of medical and nursing study programs. Critical thinking is the essential skill necessary to assess any information, explain the causes, and the ability to solve problems. University education develops this skill through strategic teaching of simulation methods.

**Methods:** In connection with new information of the method of IV cannulas by “magic movement”, we decided to use the Core model for critical reflection designed by Cottrell (2010), to evaluate new techniques in preclinical education of students from general medicine and nursing on IV cannulation in simulation laboratories.

**Results:** The results have shown that student performance levels will be increased by applying critical thinking and simulation as an option for integrated preclinical training for future healthcare professionals.

**Conclusions:** Innovative method of introducing peripheral IV cannula provides a framework to guide curriculum development and teaching strategies as well as to support the advancement of cognitive and empirical skills of healthcare professionals. A new technique for applying “magic movement” of IV cannulation, we innovate the curriculum of basic nursing practices while contributing to the development of evidence-based practice.

**Key Words:** Intravenous catheter, Innovative method “magic movement”, Critical thinking, Simulation laboratories

## 1. INTRODUCTION

The current requirements for healthcare professionals are aimed at providing evidence-based healthcare and, at the same time, under the Act of respective countries, which are subject to the EU directive. Nursing education in EU countries is nowadays conducted in accordance with the EU Directive 2005/36/EC and its amended version as Directive 2013/55/EC for regulated professions, in accordance with the Bologna Process and other guidelines relating to the education of nurses.<sup>[1,2]</sup> The higher level of nursing education is

influenced by the national education system, laws and regulatory processes as well as professionally oriented education in every single country. The training of healthcare professionals meets the requirements for the content and scope of theoretical education, training, and clinical practice considered to be a vital part of the training program.<sup>[3]</sup> New methods of the educational process in the preclinical teaching of health professionals can help to move from theoretical knowledge to the ability to apply them to clinical practice.

Critical thinking is a human cognitive process requiring fo-

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cused thinking that is self-regulated and promotes the development of knowledge to inform clinical judgment and decision-making.<sup>[4,5]</sup> Critical thinking skills are generally recognized as necessary and are the goal of teaching at universities.<sup>[6-8]</sup> There is currently no specific definition of critical thinking for health care procedures. Based on the Delphi study, which applied the method of critical thinking in nursing practice, the standard concept of critical thinking is defined as the process of informing judgment and decisions.<sup>[5,9]</sup> One of the teaching methods for developing critical thinking, teaching, and nursing self-confidence is a simulation.<sup>[10,11]</sup> The simulation includes scenarios and case studies developed to replicate real-life clinical situations and provides added value only with well-trained and enthusiastic teachers.<sup>[12,13]</sup> According to Raková, the quality of nursing care provided is related mainly to the education of health care staff. Patient safety education focuses on acquiring the knowledge, attitudes, and skills needed to support change.<sup>[14]</sup>

Legislation of the Ministry of Health of the Slovak Republic stipulates by Decree no. 95/2018 (Collections of Laws in Slovak Republic) the competences of a specialist nurse who has acquired the professional competence to perform specialized work activities. Such a nurse indicates and performs replacement and withdrawal of the peripheral vein cannula, administers a medication treatment within the dosage range and pharmacological composition based on the physician's indication and after assessing the person evaluates the effectiveness of the treatment.<sup>[15]</sup>

Physicians and nurses must be aware of the treatment indications, the main effect and side effect of the drugs they administer and, last but not least, be prepared to deal with an allergic or other adverse reaction.<sup>[16]</sup>

## 2. MATERIAL AND METHODS

### 2.1 Research design

Case report design was used to apply the model of critical reflection designed by Cottrell,<sup>[17]</sup> to evaluate new techniques in preclinical education of students from general medicine and nursing on IV cannulation in simulation laboratories.

### 2.2 Study setting

This study was conducted at the Department of Nursing Care at Medical Faculty Pavol Jozef Šafárik University Košice. The subject of the research was a new method IV cannulation investigated by medical and nursing students enrolled in the second year of study at the Department of Nursing. The teaching process took place with a set of questions that focused on the "magic movement" of what this clinical step looks like and the answers to know if students have the potential to compare old and new clinical practices through critical

thinking.

High expertise and professionalism are always associated with the application of the latest scientific evidence in practice.<sup>[18]</sup> In connection with the new information on how to introduce IV cannulas using the "magic movement" method, we decided to assess the new technique with the basic model of critical reflection in the teaching process of the course Fundamentals of Health Care for students of medicine and nursing. The primary critical reflection model developed by Cottrell<sup>[17]</sup> to facilitate a higher level of reflection to achieve a higher level of understanding of the situation is ideal for more experienced healthcare professionals, including those graduating from postgraduate studies.<sup>[17,19]</sup> The elements of the model include evaluation, reconstruction, analysis, detailed guidance, application (see Figure 1). In the first step, "Evaluate", we find out why we chose the method. The second step of critical reflection, "Reconstruct", focuses on the results achieved, expectations, and reactions. The third step, "Analyze", is aimed at examining the method by comparing it with findings in the context of evolution for current practice. There is an opportunity to develop self-confidence by confronting one's ideas and thoughts. By the fourth step, "Distil", we step by step guided, removed and modified the problem and made a synthesis of information - what are the conclusions for the future, which may slow down the desired outcome or reject it. The fifth step of critical thinking, "Apply", moves to the level of implementation and application in practice - what support do we need to apply the new method in real conditions.

## 3. RESULTS

The results have shown that student performance levels will increase by applying critical thinking and simulation as an option for integrated preclinical training for future healthcare professionals. The method of securing venous access by intravenous cannula is part of the teaching of medical and nursing study programs. Critical thinking is the essential skill necessary to assess any information, explain the causes, and the ability to solve problems. University education develops this skill through strategic teaching of simulation methods.

### 3.1 Evaluate

The first step in the Basic Model of Critical Reflection is the reason to understand the "magic movement" method. The new technique is conditioned by the knowledge level of venous anatomy of approaches as well as by the IV cannulation procedures. Intravenous drug delivery requires drug knowledge, correct application technique, physician and nurse skills to introduce a peripheral venous catheter. Inserting and positioning an IV cannula is often more complicated than

simply venepuncture with a standard needle. The problem is that we are inserting a metal needle and a plastic catheter at the same time. There is a difference of one to two millimeters between the tip of the needle and the beginning of the plastic catheter, depending on the catheter manufacturer. The metal part of the needle is one to two mm longer than the plastic catheter (see Figure 2). Insertion and position of IV cannula

can often be difficult, so the doctor and nurse must select the right cannula size and use the most appropriate injection technique when cannulating the peripheral vein. The use of the “magic movement” method reduces the traumatization of the patient by repeating the number of punctures in the IV cannula and eliminates pain.<sup>[20]</sup>

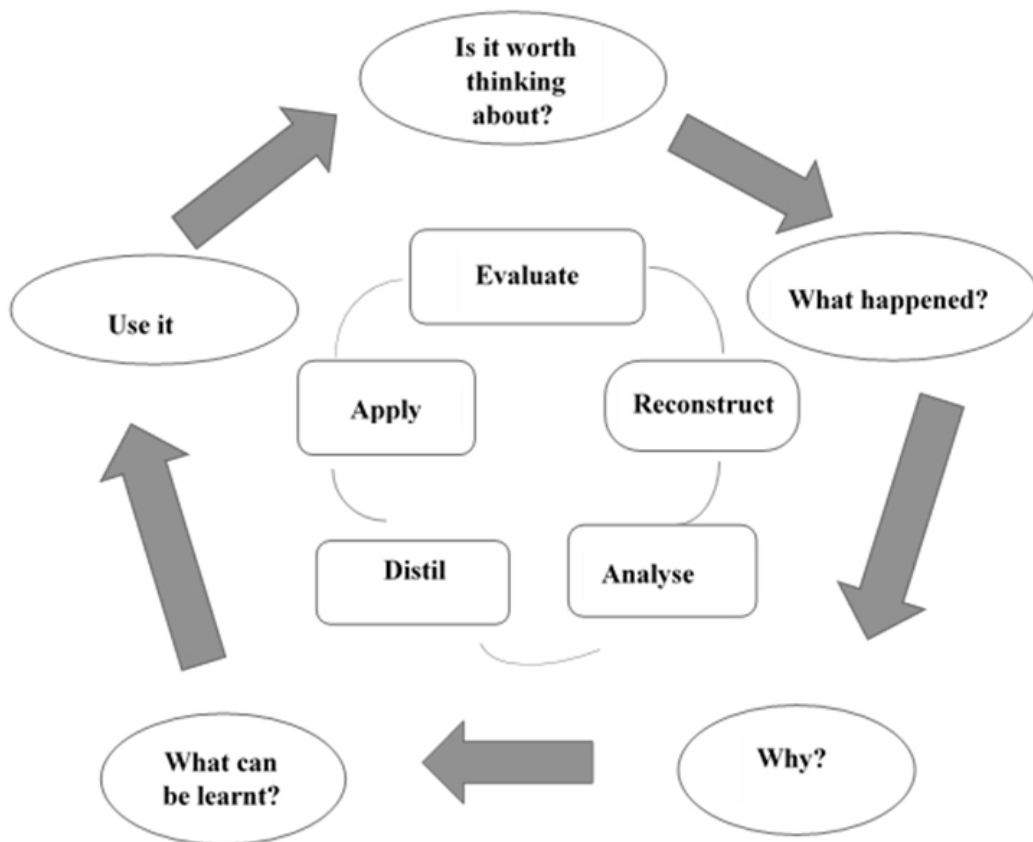


Figure 1. The Core Model for Critical Reflection designed by Cottrell<sup>[19]</sup>

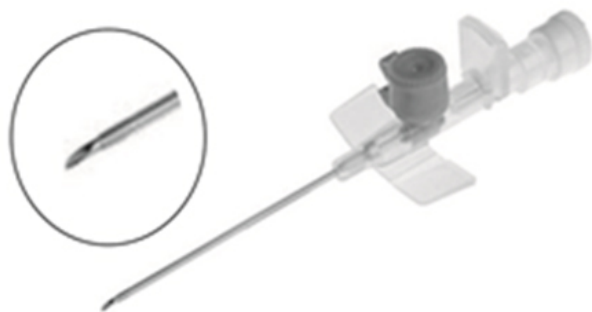


Figure 2. IV cannula

### 3.2 Reconstruct

The goal of healthcare professionals is to minimize the risk of venous puncture and proper placement of IV cannulas with the widest possible lumen. This process involves the successful installation of the needle and plastic catheter into the lumen of the vein by a standard<sup>[21]</sup> as well as a new method of “magic movement” without rupture of the posterior vein wall.<sup>[20]</sup> This procedure means we have to place at least 2-4 mm needle together with the plastic catheter without damaging (breaking) the vein (see Figure 3).

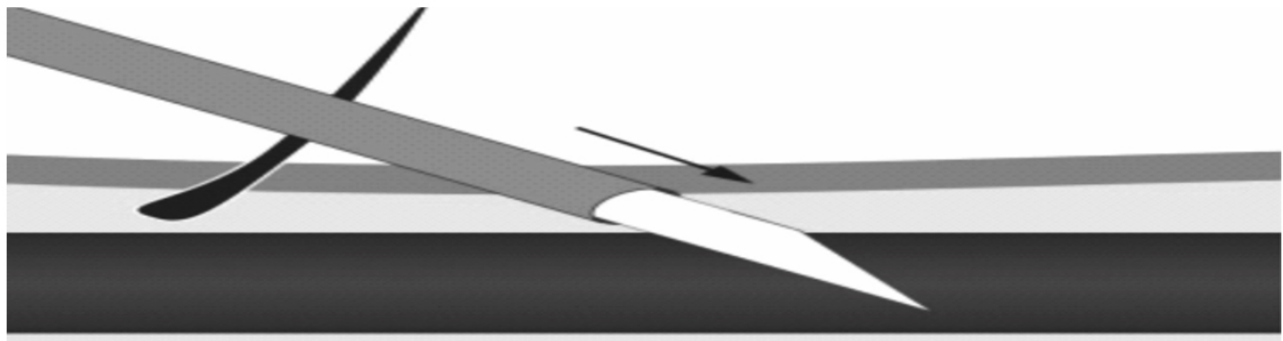
#### 3.2.1 Vein cannulation procedure

- When inserting the intravenous cannula, we always start at the periphery (the veins on the back of the hands are better fixed) so that the blood flow to the heart remains intact if the cannula is not inserted for

the first time and further attempts are required. We prefer veins with a larger lumen. We do the puncture at the vein branch.

- Put rubber gloves on and place Esmarch's tourniquet on the limb 5 to 10 cm above the anticipated injection site. We support a larger square of cellulose wadding under the limb.
- To achieve better venous filling and better estimation of the cannula insertion site, stimulate vein dilatation by tapping the skin area through the visible veins, or ask the patient to reopen and open the fist. Use your fingers to pick up the largest and most direct vein and select the injection site. Identify the vein.
- Disinfect the selected injection site in the range of 8 cm × 8 cm.
- Remove the plastic cover from the IV cannula. Grip the cannula into the dominant hand at the injection port between the index finger and the middle finger while the thumb holds the port. For cannulas without a port, hold according to the type of needle - a three-point grip (fingers in a triangle) or as a pen.

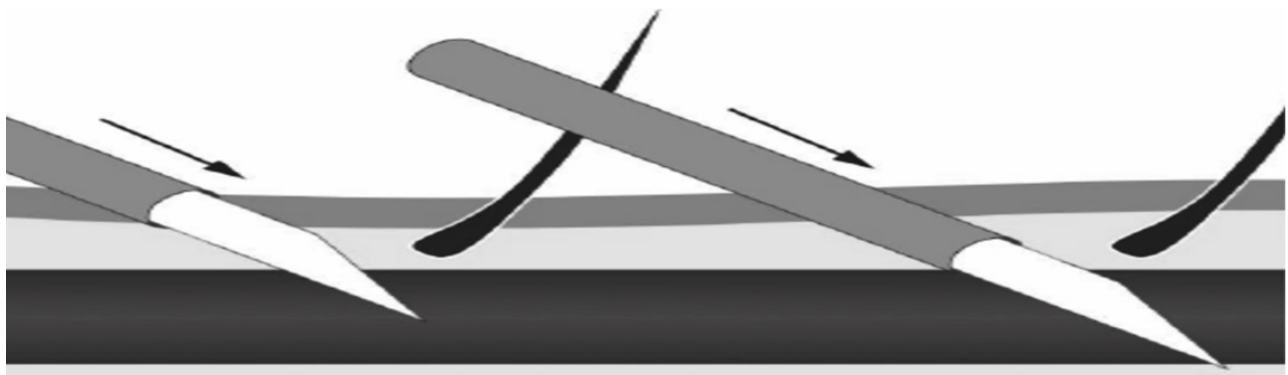
- Hold the patient's limb at the injection site from below and slightly stretch the skin. With a dominant hand, insert the cannula into the vein with smooth movement (see Figure 3).
- Insertion of the cannula. Push the cannula firmly through the skin at a 30-40° angle until there is blood in the collection chamber (the chamber has a hydrophobic filter at the end that lets out air but retains blood), then reduce the puncture angle and move the cannula into the vein by 1 cm. so that the needle and the plastic catheter are in the vein.
- Pull the needle back about 1 cm (blood appears in the plastic catheter) to insert the tip of the metal needle into the plastic catheter, providing us with stability when inserting the needle (the cannula does not bend) without injuring the vein wall. Then insert the catheter into the vein while slowly pulling out the needle (insertion must be done without much resistance, resistance means that the cannula is out of the vein).
- Release the tourniquet.
- Fix the cannula with transparent cover.



**Figure 3.** Placing both the metal needle and the plastic catheter into the lumen of the vein<sup>[20]</sup>

Some veins have a smaller lumen; therefore, cannulation may be unsuccessful because the vein back wall is often

punctured at deeper insertion, or the plastic catheter tip is not yet in the vein (see Figure 4).

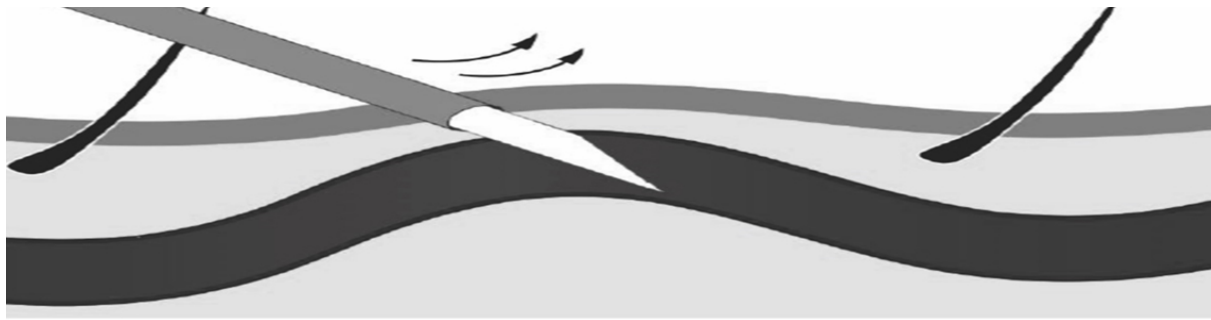


**Figure 4.** Puncture of posterior vessel wall while inserting IV cannula<sup>[20]</sup>

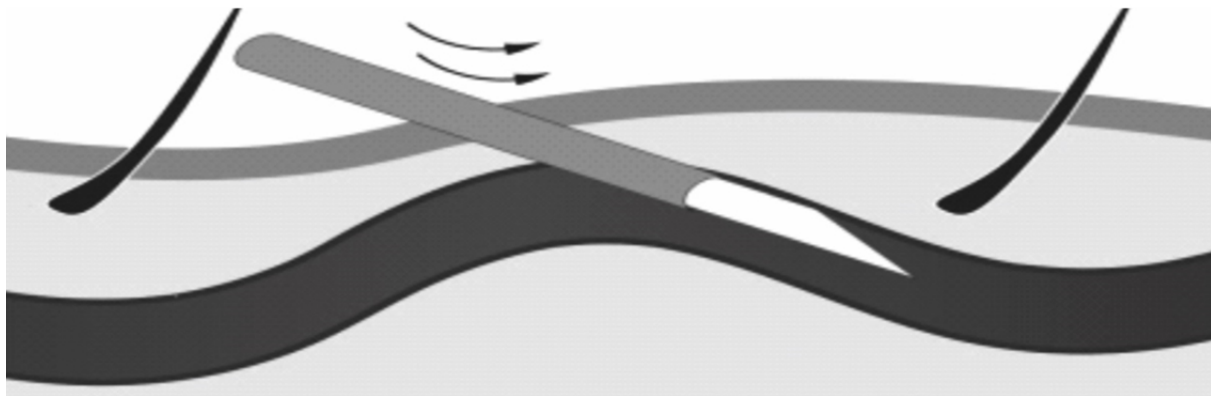
### 3.3 Analyze

In this section, we apply the “magic movement” method to the standard IV cannulation of veins. Introducing an IV cannula using a new “magic movement” technique by lifting the front wall of the vein simultaneously with the beveled part of the needle (see Figure 5). To understand and better imagine this new technique of “magic movement” in Section 7 (Reconstruction), it is necessary to realize how to utilize the standard needle bevel in the cannula. In an experiment

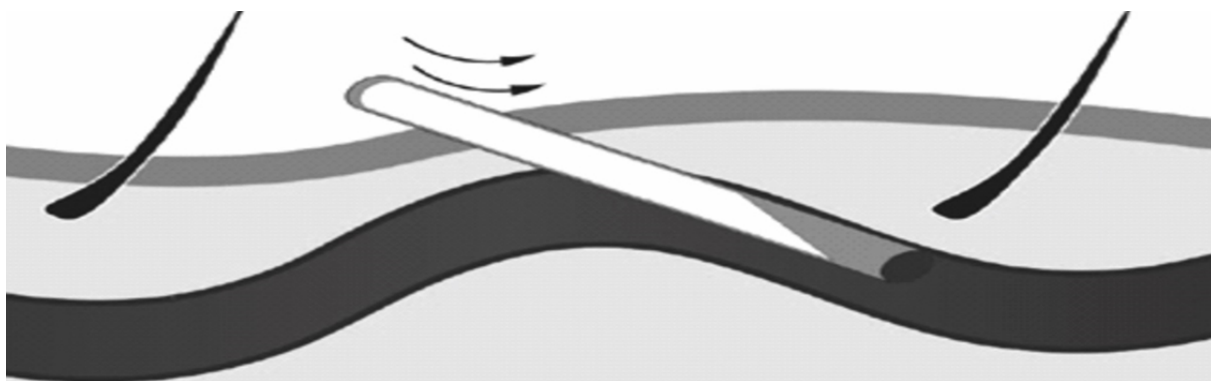
carried out on smooth paper, which first represents the front wall of the vein, we move the beveled needle tip down in different directions. You can find that the needle slides easily over the paper without damaging the paper. If the needle tip is turned with the bevel of the needle up, the paper will demonstrate the back wall of the vein. By moving the needle over the paper you will find, that that smooth movement without damage is not possible.<sup>[20,22]</sup>



**Figure 5.** Lifting the needle at the same time as the front vein wall “Magic movement”<sup>[20]</sup>



**Figure 6.** Insertion of the needle and catheter along the anterior wall of the vein while part of the catheter is in the lumen of the vein<sup>[20]</sup>



**Figure 7.** Pulling out the needle approx. 3-4 mm and inserting the IV cannula into the vein lumen 1-2 cm<sup>[20]</sup>

The reason why the possibility of lifting the catheter and needle with its beveled tip is because the vessel will bend so that its axis is parallel to the axis of the needle. When the needle axis is aligned with the vessel axis, it has more space in the vein and is less likely to puncture the back wall. Insert the needle and catheter along the anterior wall of the vein until part of the catheter is sufficiently positioned in the lumen of the vessel (see Figure 6). Pull the needle approx. 3-4 mm and insert the catheter deeper into the needle lumen approx 1-2 cm (see Figure 7).

Demonstrating a technique where we lifted the needle and catheter by about 1 cm without damaging the posterior vein to show students that this new technique will not rupture the posterior wall while demonstrating that “magic movement” does not damage the front vein wall either.<sup>[20]</sup> Demonstration of the “magic movement” method was part of the preclinical teaching of the subject Basics of health care for students of general medicine and nursing in simulated laboratories. The “magic movement” technique is presented in the media by the author himself.<sup>[22]</sup>

### 3.4 Distil

The new method of “magic movement” is based on the experience of standard intravenous cannula application in clinical practice. For the understanding and application of the innovative method of “magic movement” by the method of critical reflection, we achieved a higher degree of understanding IV cannulation. This innovative method is particularly suitable for veins with less luminance, where the risk of damage is much greater. It is not only about the damage of the vein itself, but also the overall traumatization of both adult and child patients. The application of the innovative method in practice can be influenced by the long-term practical experience of healthcare professionals, as the authors of the article state in their method.<sup>[20]</sup>

### 3.5 Application

In general, critical thinking is considered a “cognitive engine” that drives professional opinion and competent decision-making.<sup>[23]</sup> Healthcare is constantly subject to challenges that require the integration of knowledge from different sources. Healthcare professionals need intellectual flexibility to integrate knowledge with clinical rationale and provide the best for the patient.<sup>[24,25]</sup>

From our point of view and applying critical reflection, this new technique is a challenge for implementation in the educational process and clinical practice. We tried this method in practical exercises on a simulator of peripheral venous catheter insertion in a simulation laboratory with a group of students of medicine and nursing. However, the new “magic

movement” technique needs to be examined and validated by medical doctors and nurses. The empirical experience will need to be systematically verified if an evidence-based practice is to be implemented. To obtain statistically significant data to show the benefit of the new method is necessary to apply innovative technology to nursing and postgraduate education of nurses and doctors.

The results showed that the level of student performance was increased by applying integrated training - simulation and the Core model for critical reflection. They declared that they feel more comfortable and more self-confident in preparing for clinical decisions making when they try different approaches for the same clinical situation (in our case IV cannulation). That is why we join to authors’ opinion of the new “magic movement” that the technique has to be more visible for healthcare providers and formally tested in health care settings.<sup>[20,22]</sup> By using the clinical experience associated with the development of critical thinking in education, a higher degree of flexibility in practical skills and, thus, a higher level of patient safety can be achieved.

## 4. CONCLUSIONS

Critical thinking is a fundamental skill that healthcare professionals should develop in the context of acquired knowledge and practical experience. Assessing any information, explaining the reasons, and being able to apply an innovative method of intravenous cannula insertion by “magic movement” should be a challenge for scientific investigation in clinical practice as well as innovation of the teaching process of future healthcare professionals.

The ability to apply critical thinking in the selection and verification of new information is an essential skill and is becoming one of the main goals of university teaching. This creates opportunities for students and teachers to receive and evaluate knowledge, clarify concepts and ideas, look for different perspectives and alternative approaches to solving problems. The validation of new clinical practices in simulation laboratories, which reflect the latest evidence-based knowledge, will enable students with critical thinking support to understand the meaning and content of new information. A student who is able to think critically is able to communicate, reflect, criticize and examine content with his own critical judgment.

Due to the lack of practical experience of students in inserting IV cannulas cannot be evaluated to determine whether the “magic movement” method is more effective in practice. However, by applying the Basic Model of Critical Reflection and Strategic Teaching by simulating a “magic movement” technique, we evaluate that there is scope to test the method

directly in practice by physicians and specialists nurses. At the same time, we perceive the new method as a convenient alternative when introducing IV cannulisation from various manufacturers. We believe that the intravenous entry technique, both standard and “magic movement”, is one of the options for intravenous entry security in the context of prac-

tical experience and the use of critical reflection, which can also contribute to more patient safety and satisfaction with a professional approach.

## CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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