SIMBASE
Healthcare • Education • Technology

A Management Model For Simulation Based-training Oriented Towards Impact Evaluation

PUBLIC
To be distributed outside of the partnership

SIMBASE consortium

Leader:
CONSEJERÍA DE SALUD Y BIENESTAR SOCIAL. JUNTA DE ANDALUCÍA.

Authors:
Teresa Campos García (CSJA), Yusnelkis MIlanés Guisado (CSJA), Christian M. Stracke (UDE), Tatiana Shamarina-Heidenreich (UDE)

Contributors
- Tatiana Shamarina-Heidenreich (UDE)
- Armando Romanos Rodríguez (CSJA),
- Carmen de Vicente Guilloto Teresa Campos García (CSJA),
- Almudena de la Serna Bazán (CSJA)

Acknowledgments to Andalusian Public Health School:
Sandra Pinzón Arlette; Cecilia Escudero Espinosa

Editors:
Teresa Campos García (CSJA), Yusnelkis MIlanés Guisado (CSJA),

Layout:
Teresa Campos García (CSJA), Yusnelkis MIlanés Guisado (CSJA),

The SIMbase Consortium:

1. Consejeria de Salud de la Junta de Andalucia	JDA	ES
2. Laerdal Medical AS Jorge Vilaplana	LM	NO
3. Faculdade de Ciencias de Saude, Unversidad de Beira Miguel Castelo Branco, Isabel Neto	UDB	PT
4. Fundacion IAVANTE David Riley, Juan Chaves, Javier Vázquez, Iván Herrera	IAV	ES
5. University of Duisburg-Essen Christian Stracke, Tatiana Shamarina-Heidenreich	UDE	DE
6. National Institute for Quality- and Organizational Development in Healthcare and Medicines Ildikó Szögedi	GYEMSZI	HU
7. Postgraduate Deanery Wales James Ansell, Jared Torkington, Neil Warren, Peter Donnelly	PDW	GB
8. Knowledge Innovation Centre Justin Fenech, Anthony Camilleri	KIC	MT

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Document Title	A management model for simulation based-training oriented towards impact evaluation.
Project Title	Promotion of ICT enhanced Simulation Based Learning in Healthcare Centres (SIMbase)
Grant Agreement No	2010-4079 / 001-001
Workpackage	WP 4 – –Maximisation of impact and integration of ICT-based Patient Simulation
Confidentiality Status:	Public

Número del proyecto -511811-LLP-1-2010—1-ES-KA3-KA3MP
Programa: Lifelong Learning Programme
Sub-programa: KA3 ICT
Convocatoria: DG EAC/41/09
Accion: Multilateral projects
Sub-Accion: N/A

Table of Contents

0. EXECUTIVE SUMMARY 07

1. GENERAL INTRODUCTION 11

2. THEORETICAL FOUNDATION 13

2.1 Health professionals education and the training of healthcare professionals: The role of simulation 13
2.2 Literature review of simulation-based training. Premises for implementation 14
2.3 Training impact evaluation. Specificities of experiences in simulation-based training 19
2.3.1 Key problems on training impact evaluation 34

3. MODEL DESCRIPTION 37

3.1 Range and objectives 38
3.2 Methodology 39
3.3 Proposed management model for simulation-based training oriented towards impact evaluation 42
3.3.1 Initial evaluation 44
3.3.2 Satisfaction/reaction 51
3.3.3 Learning 54
3.3.4 Transference: Behaviour/performance 56
3.3.5 Legacy/impact 62
3.3.6 Simulation profitability (ROI) 71

4. APPLICATION OF THE MODEL: EVALUATION MANAGEMENT 75

4.1 Recommendations for evaluation implementation 75
4.2 Subsequent actions, piloting and development of tools 86

5 REFERENCES 88

0 EXECUTIVE SUMMARY

The prestigious Carnegie Foundation of North America, a foundation for the advancement of teaching and learning, published a review of the status of medical education one hundred after the Flexner Report (1) in which it revealed the context of radical changes currently affecting the training of healthcare professionals.

The demand for the application of innovative educational technologies to the training of healthcare professionals stems from the need to both guarantee patient safety and to consider patient safety as a key component in educational curricula. This may be achieved through well designed training programmes that promote both improvement in competencies and behavioural modification. In this regard, the World Health Organisation, in one of its founding documents - "The World Health report: Working Together for health (2006)" - considers that organisations have the responsibility to provide both a suitable education system and the necessary support to enable its workforce to learn and apply the knowledge and skills required for patient safety (WHO, 2006).

The importance of demonstrating the effectiveness of simulation is central to the quality and safety of healthcare. It is also important to understand, and this is the assumption of this model, that simulation is an efficient and effective educational methodology only when it is implemented in an appropriate manner. Simulation is currently gaining relevance both on a European and an international level and is being endorsed by development policies in many countries where the importance of the role of simulation in healthcare and education is recognised.

Given the importance and relevance of simulation, and the demands that must be met by health and education policy managers and administrators, it is clear that the development and implementation of simulation must be performed according to an impact-oriented management model.

Beginning with this premise, this document will present a proposal for a simulation-based training management model oriented towards impact evaluation in the context of the European SIMBASE Project which, in itself, seeks to promote ICT-based simulation in order to improve the quality of healthcare training. With this in mind, the proposal is to create a useful conceptual framework for the development of a second pilot guide which will allow us to validate and consolidate the organisational strategy for simulation implementation, maximising the benefits on all levels of healthcare and education organisations through the implementation of an impact-oriented integrated management model.

We shall begin, then, with the assumption that simulation is efficient and effective when applied to healthcare training programmes, and that it can, and should, be used and implemented on an institutional level as a support tool for health and education policy managers and administrators. Sufficient documentary evidence exists to support a second premise, which we shall also assume, i.e. that the success of the implementation of simulation-based training programmes in healthcare organisations is closely related to the context and organisational strategies in which the training events are performed. This is true for both healthcare and education organisations.

A combined strategy is required, therefore, which in turn requires the commitment of the decision makers in the healthcare and education organisations, as can be seen in other products developed by this project: Implementation handbook for simulation in training and healthcare centres and Decision-makers' roadmap for simulation implementation. Along these lines, we shall begin with the premise that the success of implementation of simulation-based training programmes in healthcare organisations is, among other factors, closely related to both the context and organisational strategies in which the training events are performed and the necessity for collaboration of all those involved.

This requires consideration of a number of complex factors that are inherent in the healthcare and education systems and that affect learning processes and results, transfer of competencies to the workplace and both short and long-term impact (workplace and organisational performance, improvement in health indicators, etc...). In any case, as we have seen, this is not a linear process. It is a complex process that requires suitable assessment and evaluation, by both direct and indirect methods, of simulation-based training events for healthcare.

A first draft was produced by the University of Essen, one of the SIMBASE project partners, containing initial approaches to different conceptualisations of training impact. This document, titled Simulation Impact Evaluation Model, was developed during the first phase of the project.

On the basis of this document, an initial Handbook was developed as a guide to the performance of training activities that include simulation in four countries (Hungary, UK, Portugal and Spain) and three different scenarios: graduate training, specialised training and on-going training. As a result of this experience, and following the incorporation of most of the ideas provided by the three external reviewers involved in the development of the document, the second proposal model, described in this document, has been developed under the title A management Model for simulation-based training oriented towards impact evaluation

The proposed model provides a coherent integration of the educational principles published by Kirkpatrick (Kirkpatrick, 1996) and other authors, which include the analysis

of training profitability and simulation models and experiences that are based on the evaluation of learning results.

The model offers a conceptual framework which consists of a series of dimensions, analysis indicators and evaluation tools recommended for five basic evaluation levels:

- Initial evaluation or diagnosis
- Evaluation of satisfaction
- Evaluation of transfer and practical clinical behaviour
- Evaluation of impact on trainees, the organisation and the healthcare community.
- Simulation profitability (ROI)

The principle novelty of this proposal is the logical integration of critical success factors for simulation implementation that have been revised and evaluated during the SIMBASE experience.

The inclusion of these factors (curricular integration, deliberate practise, orientation towards requirements, educational and organisational context, feedback and debriefing, team-based learning, simulator and scenario fidelity) enriches the model by providing analysis of elements that increase the chances of success and, therefore, the probability or positive repercussions in different clinical and educational fields. Furthermore, taking these factors into consideration allows us to make realistic measurements that are coherent with the complexity of clinical practise. At the same time, other general training factors that may constitute either obstacles or facilitating agents for the transfer of competencies to clinical practise are taken into consideration.

The current proposal is limited to providing conceptual reference points in a logical order for the performance of an impact-oriented simulation management evaluation. The development of evaluation tools and their validation and piloting will be the subject of the second development phase.

1 GENERAL INTRODUCTION

The European Observatory on Health Systems and Policies has pointed out that the factors that affect human resources in healthcare basically respond to a variety of demographic, technological, financial, political and organisational influences (Dubois et al., 2006). Similarly, the WHO, in the World Health Report 2006, expressly states that the new paradigms for healthcare require a response from the work force, highlighting (OMS, 2006):

"...recognition by the experts, the professional bodies and the health workers themselves of the inadequacies of traditional training and deployment of the workforce, and the imperative new approaches".

The new environments and requirements for the sustainability of a public healthcare system require analysis of how to provide the best response.

Healthcare systems will be in the best position to provide optimum response if, among other factors, they have at their disposal suitably qualified professionals with the appropriate combination of competencies.

Analysis and revision of training-learning models in general, and, in particular, their efficiency and effectiveness, are required. We are faced with a context of change and transformation in Health Science Education.

In EU 2020 strategy, the recipe for the current economic crises includes development of an intelligent, sustainable, integrated economy with high levels of employment, productivity and social cohesion. Intelligent growth requires development of an economy based on knowledge and innovation and, as such, increased investment in intangible capital comprising investment in training, instruction, R&D activities, information and coordination, in other words, investment dedicated to the creation and transmission of knowledge.

The expansion of the economy into the knowledge society resides in multiplication of knowledge-intensive communities which are characterised by a significant capacity for production and reproduction of knowledge, public and semi-public spaces for sharing learning and the extensive use of ICTs.

The European Space for Higher Education integrates a series of objectives for aligning higher education with social requirements within the framework of the 2020 Strategy. Among them is the promotion of changes in teaching methods in order to focus the objectives on student learning in a context that continues throughout his or her lifetime.

The curricular reforms essential to the Bologna Process include the following aspects: competency-based training, flexibility, individual itineraries, training based on practise and experience, incorporation of ICTs and the promotion of transversal competencies.

2 THEORETICAL FOUNDATION

2.1 Medical education and the training of healthcare professional: the rol of simulation.

These reforms need to go hand in hand with innovation in education methodologies. When we adopt innovative methodologies, and especially through the use of ICTs, we are refining existing approaches, an essential approach if we are to offer healthcare professionals the necessary skills to ensure safe, effective treatment of the patient. Innovative education technologies provide proven opportunities for healthcare professionals to acquire develop and retain the knowledge, skills, values and behavioural aspects required for safe, effective treatment of the patient.

The use of simulation for clinical objectives is a procedure used in healthcare education that takes place in situations that simulate clinical surroundings with the aim of acquiring the technical skills and competencies required for healthcare (Bradley, 2006). In other words, learning takes place in an environment that reinforces patient safety while improving competencies through deliberate, repeated practice. Repeated practice allows skills to be developed through the experience of repeated errors. Simulation should not be a substitute for real-life supervised practice, but should provide a complementary element to safe, effective practice.

Education providers, as well as public authorities and decision-makers, have traditionally made significant investments in simulation-based learning in order to improve training, learning and development of healthcare professionals.

From a strategic and political perspective, examples of the strategic role of simulation-based learning have appeared on an international level and, in countries such as the UK, Australia, France and Canada, significant conceptual frameworks regarding the role of simulation in education and practise have been developed. Reports by the National Institute of Health Research (NIHR, 2008, 2011), as part of the national framework of recommendations for policy makers in the UK for the adoption of learning technologies, highlight the need for simulation and its incorporation into organisational strategy, stating that healthcare professionals should acquire skills in simulated environments before putting them into practise in supervised clinical practise. Research by National bodies, such as the National Council of State Nursing Boards shows high levels of support for the use of simulation in place of traditional clinical experiences (Spector, 2006).

Reports of a more political nature, such as the Chief Medical Officer's Annual Report, 2008, 'Safer Medical Practise', and the Scottish Clinical Skills Strategy report, highlight the relevance and application of simulation in healthcare. International regulatory bodies also support the role of simulation in relation to the accreditation process for healthcare professionals and the General Medical Council, the Nursing and Midwifery Council and many royal colleges have designed standards for the incorporation of simulation.

With regard to Spain, the autonomous region of Andalusia has its own Strategic Plan for Comprehensive Training (2008) which, along strategic lines, includes the development and initiation of a Simulation Plan for Andalusia that requires a number of actions including the incorporation of simulation into the curricula of training specialists during their residency period and specific collaboration agreements with scientific bodies (CSJA, 2009).

Ensuring the safety and privacy of the patients during the professional's learning cycles has become an ethical requirement and, indeed, one which may come into conflict with training practises that include patients at any stage of the professional education process. The use of simulations may, on the one hand, make professional training more suitable and, on the other hand, contribute to minimalizing the aforementioned ethical conflict (Ziv, 2003).

We know that the possible improvements in patient safety and healthcare results that can result from simulation-based learning depend on an implementation process that is in accordance with patient requirements, the healthcare service, and the degree of integration with the educational processes in the healthcare or education centre, or university.

A more strategic approach to evaluation requires selection of those variables that are directly related to student learning results. The first step in evaluating the learning process and its results, therefore, is to identify the critical success factors for the process and evaluate their presence.

Following the experience of the SIMBASE Project, and an exhaustive examination of relevant documents, we will propose a set of critical factors for the use of simulation which will be used to develop the proposed evaluation model.

2.2 Literature review of simulation-based training. Premises for its implementation.

When we speak about simulation, we refer to a reproduction or approximation to a 'real-life' event, or process, or to specific conditions or problems. With this methodology, then, the students are expected to evaluate and act as though they were in a 'real' situation.

Among the many definitions of simulation, we can cite that of Gaba (2004), who defines it as:

"Simulation should be interpreted as a strategy, not a technology, which reflects,

anticipates, or amplifies real-life situations with fully interactive guided experiences. The simulator replicates a working environment with sufficient realism to serve the desired purpose."

Simulation has been in use since 1910 as a means of training both individuals and teams and for reducing errors and improving safety (Fowlkes et al, 1998). Both commercial and military aviation have invested heavily in simulation-based training as it offers a realistic, safe, affordable and flexible environment for acquiring the competencies required to perform a particular task (Salas et al. 1998). In the aviation field, for example, the industry has developed high-fidelity flight simulators for improving non-technical skill using programmes for the handling of flight teams. Since their inception, nuclear power plants have used simulation-based safety programmes in which knowledge of the reactor and behaviour in the event of a crisis is 'rehearsed' on a regular basis using simulation (Palés and Gomar, 2010).

Medical simulation has also been in use for several decades, at least since the 50's, providing alternative teaching and learning methods, though its evolution has not been as expeditious as in other areas. Using simulation, health workers both learn and err through repeated practise of the skills they have been taught before interacting with 'real' patients.

Within the healthcare sector, a number of areas already use simulation-based training in order to help individuals and teams improve patient safety (Salas et al, 2005). Throughout the medical institutions of Harvard University, simulation-based training offers creative methods for testing new ideas as well as for training and reinforcing established ones (Berry and Cooper, 2006).

Many simulation-based training experiences have demonstrated the benefits of simulation for healthcare and education. In this sense, simulation has been employed with positive results for the training of psychomotor skills (Hravnak et al, 2007), critical thinking skills through clinical practise and communication (Jeffries et al, 2003, Schoening et al, 2006), competency evaluation (Ebert & Connors, 2004), development of clinical judgement (Lasater, 2007) and non-technical skills (Flin et al, 2003, Mitchel and Flin, 2008).

Within the family of innovative education methodologies, simulation is included among the paradigms and bases for practise-oriented teaching. From this perspective, simulation is based on fundamental principles such as adult learning, experience-based learning and deliberate practise. Adult learning is based on the fact that simulation promotes self-motivation and self-guiding in adults, that the adults approach learning in a way that is both practical and objective-oriented. Adults wish to know the relevance of what they are learning, an aspect that is provided for by the reflection and debriefing phases.

Orientation of simulation towards experience-based learning is demonstrated by the possibility of learning through mistakes and

repeated practice before interacting with the patient (Broussard, 2008, Salas et al, 2005). Students learn through experience without the distractions of a real-life environment, in situations wherein mistakes made during skills learning can be seen as a value-added opportunity in learning (Broussard, 2008). This type of learning is ratified by what is known as the experience-based learning model, Kolb (1984), or the natural learning cycle of the 4MAT Model from Bernice McCarthy (1987).

Suitable identification of the critical factors for the success of simulation implementation is a core aspect in the guarantee of quality of the simulation programmes and their benefits for the trainees, the organisation and the healthcare community as a whole. A number of meta-analysis studies synthesising these factors have been documented. Based on the piloting experience and document analysis performed within the framework of the SIMBASE project, the following strategic proposal has been developed (See table 1):

SIMBASE Proposal	Issenberg et al. (2005)5 (qualitative, systematic review spanning 35 years, included 670 peer-reviewed journal)	McGaghie WC et al (2010) (This qualitative synthesis of SBME Research 2003-2009)
1. Needs orientation; 2. Resources avaiable 3. Course desing 4. Team-based learning 5. Feedback 6. Deliberate practice 7. Curriculum integration 8. Instructor role and training 9. Simulation fidelity 10. Skill acquicition and maintenance 11. Transfer to practice 12. Outcomes measurement 13. Organizational and educational context	1. Feedback is provided during the learning experience 2. Learners engage in repetitive practice 3. The simulator is integrated into an overall curriculum 4. Learners practise with increasing levels of difficulty 5. The simulator is adaptable to multiple learning strategies 6. The simulator captures clinical variation 7. The simulator is embedded in a controlled environment 8. The simulator permits individualised learning 9. Learning outcomes are clearly defined and measured 10. The simulator is a valid (high-fidelity) approximation of clinical practice	1. Feedback; 2. Deliberate practice; 3. Curriculum integration; 4. Outcome measurement; 5. Simulation fidelity; 6. Skill acquisition and maintenance; 7. Mastery learning; 8. Transfer to practice; 9. Team training; 10. High-stakes testing; 11. Instructor training, and 12. Educational and professional context.

Table 1: Critical success factor for implementation of simulation based learning.
Source: SIMBASE (2013), Issenberg et al. (2005), McGaghie WC et al (2010)

One of the critical factors most relevant to simulation is deliberate practise (Issenberg, SB et al, 2005, McGaghie et al, 2010, 2011). This premise is based on the fact that simulation-based training allows for repeated practise and the quest for excellence through error correction, feedback and debriefing, etc., thereby helping to promote on-going development of the healthcare professionals.

Another fundamental factor is the suitable design. Performance of a training activity that includes simulation, as with any other training activity, requires planning and administration of the training process.

For simulation fulfill its purpose, it is necessary to ensure the fidelity of the simulator as scenarios. Simulation is generally classified as high or low fidelity. In the context of simulation, fidelity refers to the degree of precision with which the simulated environment reflects the clinical reality if the situation we are attempting to reproduce (Littlewood, 2011). In this sense, simulation may be defined into three categories: environmental, equipment fidelity and psychological fidelity. Environmental refers to the realism of the environment in which the simulation takes place. Equipment fidelity refers to how similar the hardware and other tools and software used are to those used in clinical practise.

Psychological fidelity is used to measure the degree to which the simulation reflects the emotional and behavioural aspects of a real-life situation, a factor which does not necessarily depend on the use of expensive equipment or complex environments. There is increased evidence to suggest that it is more important for simulation to be cognitively effective than it is for it to be high fidelity per se. While SIMBASE shares this point of view, and defence of this point of view is becoming increasingly more of a challenge.

Patient care depends on good teamwork. Along these lines, simulation, as an educational methodology, transcends the individual and the cognitive, allowing teams to orient themselves towards safe practises and reduce the risk of complications with the patients. Upon examination of research articles dealing with tendencies in this area up until 2020 (Bradley, 2006), team-based training was identified as a fundamental characteristic of simulation given that the interaction generated by the training itself encourages learning from the beginning of the learning cycle to the application in the workplace.

Simulation provides feedback and debriefing on student performance that is highly relevant to clinical practise training, and this scenario is also used to develop non-technical skills such as teamwork and leadership and communications skills.

Research suggests that high quality simulation coupled with high levels of supervision has great potential for improving the degree of confidence and skills acquisition in healthcare professionals. Its success in promoting learning, however, requires consideration

of other critical factors, such as those related to suitable orientation towards the learning requirements of the professionals with respect to the healthcare and patient care services.

There is sufficient documented evidence to suggest that clinical simulation increases self-efficacy. This affirmation stems from social learning theory itself which states that individuals learn more by observing others (Bandura, 1986). The central point of this theory is self-efficacy and, in this sense, simulation allows students to practise repeatedly by imitating skills through observation. Simulation allows for behavioural development through learning by substitution or imitation.

It has been convincingly demonstrated that simulation promotes transfer of learning to the workplace. This transfer requires either modification of behavioural patterns that existed prior to the learning or the development of greater dexterity in the skills that had been acquired before the training event. Ensuring the transfer of competencies to clinical practise in the workplace is a critical factor which must be evaluated and, if it is attained, will in turn lead to promotion of the implementation and dissemination of clinical simulation.

The use of simulation, however, should not be a substitute for supervised practised in real-life environments, but, rather, should serve as a complement to safe, effective practise. This is the line taken by our proposal, bearing in mind that the effects on the students and in the organisation itself are greatly increased if simulation can be coherently integrated in the organisation as an innovative education methodology that improves the practical experience of the students. For this reason, Gaba (2004) considers simulation to be a strategy that should be assumed by the organisation in response to the healthcare learning requirements and that should be coherently incorporated into the curricula of the professionals. Reinforcement, then, of effective learning can be achieved by analysis of the educational context at the time of development of the training itinerary. With access to suitable qualified trainers and repeated practise, analysis can become a facilitating element that promotes other critical simulation success factors.

If we further analyse the necessity for a suitable orientation towards the health requirements and the corresponding competency requirements of the professionals, it is imperative that the work context be favourable to the training activity, or identifies the training as an activity relevant to the attainment of its objectives. The work context must also constitute a facilitating agent for the transfer of learning to the work place by ensuring the required opportunities for application.

2.3 Training impact evaluation. Specifics of simulation-based training

About training impact evaluation.

The theory of evaluation of training results is directed towards identification of relevant, and, in many cases irrelevant, effects in the short, medium and long-term. These medium and long-term effects are the subject of impact evaluation. Impact evaluation is considered as "a process oriented towards measurement of the results obtained (changes and causes) for training actions developed in the original socio-professional scenario over time" (Fernández Lafuente, 2006:20). Its objective is to measure the results sometime after the performance of the training activities and the effects that these have produced in the workplace and in the organisation.

Some studies (Stufflebeam, 2002; Biecinto and Carballo, 2006) focus the evaluation exclusively on the results and fail to take into consideration aspects circumstantial to the evaluation itself, such those relative to the context, the income generated, or the processes.

A training management model that ensures quality of the results implies a process-focused approach to evaluation that takes into account the training process as a whole, from the identification of requirements, to the long-term effects on individual or institutional activities, or on the sectors, or regions that, in turn, benefit from these activities (Aderito, 2005).

Along these lines, training impact evaluation should be coherently integrated by gathering all the information relevant to the processes from the beginning of the training activity. An isolated evaluation of the potential effects in the medium and long-term may be considered an error which would negatively affect the results of the evaluative action, bearing in mind that many factors inherent to the educational process and the training environment may have an effect on the final results.

To some degree, we are also aiming further afield than mere verification of the behavioural changes in the workplace or analysis of the results for the organisation, however much we investigate their causes prior the training activity. This method of impact evaluation, then, becomes in itself a strategy for evaluation of the training activity that reaches beyond the time and place where the training occurs.

Evaluation is performed on the basis of a series of dimensions, factors and indicators, and the majority of documented models approach evaluation on the basis of a study of learning levels or analysis dimensions, each of which contain advantages and disadvantages with respect to our proposal. It is not our intention to faithfully adapt any one of these models or combine a number of different approaches.

The Kirkpatrick model (1967, 1996, and 2007) is one that provides an initial educational foundation, given its simplicity and viability - two basic factors in impact evaluation studies. On its own, however, it is insufficient if we bear in mind the need to integrate aspects relating to the return on investment in simulation and the possible influence of other factors on the success of the training experience.

Regarding return on investment analysis, the Phillips (1997), Wade (1994) and Pineda (2002) models provide a higher level of analysis that include the financial impact of training.

Along these lines, other interesting models provide logical links between a number of elements, such as the analysis of the influence of context (see International Labour Organisation), or the attainment of the desired changes based on investment, the processes developed and the results obtained on different levels (Billororu et al, 2011). Others offer tools and levels for the evaluation of learning in clinical practise and are often used in trainee performance evaluation, such as is the case with Miller's Pyramid (Miller, 1990) and the PRIME model (PRIME, 2011).

The exclusive adaptation of any of these to a training programme evaluation model, however, would merely offer a reductionist model with regard to profitability and/or the lack of consideration of practical clinical elements which further complicate the real situation under evaluation and should be taken into consideration in the design of any coherent, realistic model.

Along these lines, there are models which are oriented towards analysis of factors that influence the transfer of acquired competencies and which enhance the evaluation of training impact. Examples of these are the Holton (1996, 2000) or Tejada (2007) models which offer a series of factors relating to motivation, the environment and the capacity for realisation of the transfer (Holton, 1996), or a series of conditioning factors prior and subsequent to training which may affect the success of the transfer (Tejada, 2007).

Below we shall provide a summary of factors that, from the point of view of general training results evaluation, may provide elements that are relevant to the present proposal:

- The Kirkpatrick model.

The Kirkpatrick model (Kirkpatrick 1996, 2007) is one of the basic models for training evaluation, providing four basic levels for measuring the responses and results of an educational event

- Level 1: Reaction. Student reaction. (Satisfaction))
- Level 2: Learning: Acquisition of knowledge, skills and attitudes.
- Level 3: Application/Changes in performance.
- Level 4: Results: Changes in organisational practises.

Level	Dimensions	Principal evaluation questions
Level 4: Results	Changes in organisational practises. Posterior system benefits.	What results have been obtained in the organisation? In the patients? To what degree has system competency quality improved? Has the activity been profitable for the system?
Level 3: Behaviour	Application/Changes in performance. Transference	Did the students change their behaviour on returning to the workplace? To what degree have the knowledge, skills and attitudes acquired been transferred to the workplace?
Level 2: Learning	Acquisition of knowledge, skills and attitudes	What knowledge, skills or attitudes have been acquired?
Level 1: Reaction:	Reaction. Student satisfaction.	How did the students react to the training? Are they satisfied? Are they motivated?

Table 2: Evaluation levels. The Kirkpatrick model (Kirkpatrick 1996)

While its principle advantage is its practicality, it being the model most widely used by trainers and training impact evaluation managers, it should be remembered that, while it offers an important basis for this type of study and, as such, is included in this model, the model on its own does not take into consideration all the factors and aspects that influence the learning results under evaluation. Adams (2001), for example, considers the Kirkpatrick model to be defective as, according to the author, it is a simplistic model which fails to quantify the true impact of the training as the results, or consequences, of the evaluation can rarely be seen as impact.

- Miller's Pyramid:

Miller's pyramid describes and measures the competencies identified in medical education. The pyramid proposes various levels of measurement, beginning with knowledge, skills and attitudes acquired on the first level (Know), to the second level (Know how) where the capacity of the students to use these competencies is evaluated, level three (Show how) in which the students must demonstrate their behaviour and performance under supervision and evaluation conditions and, finally, level four (Does), in which the students incorporate this behaviour into their daily practise.

Next figure shows the pyramid with its respective levels. The Know how and Does levels bear a close relationship to performance and transfer of clinical competencies.

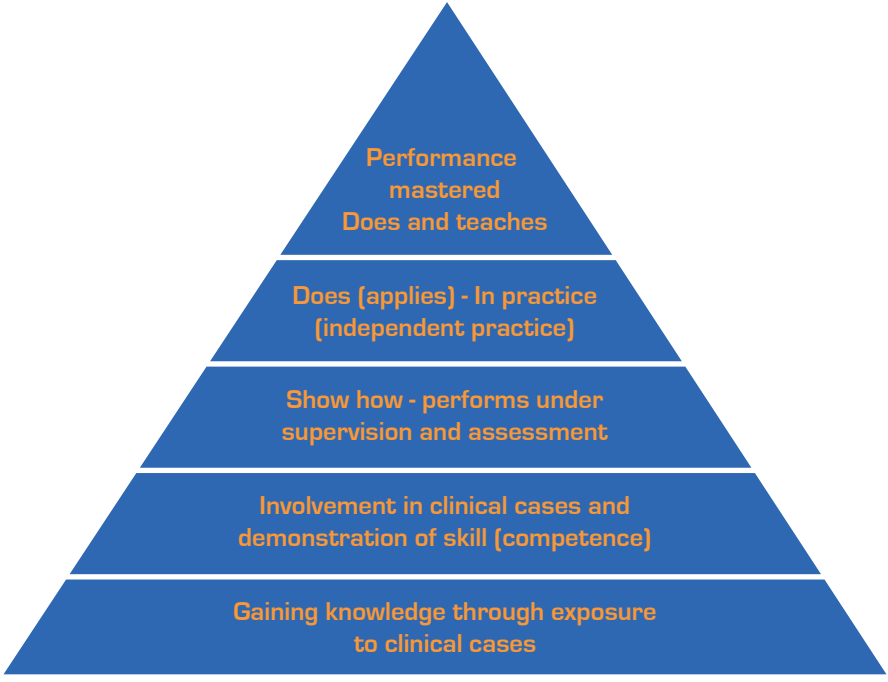


Figure 3: Miller's pyramid of competence in the medical sector.
Source: Miller, G. E. (1990),

This table shows a list of evaluation methods generally used for each level.

Level	Explanation	Assessment methods
Level 5: Does and teaches	Performance mastered	
Level 4: Does (applies)	In professional practice: performance in context (independent practise)	Performance observation
Level 3: Shows how	Performs under supervision and assessment	Controlled assessment methods: Objective Structured Clinical Examinations
Level 2: Knows how	Involvement in clinical cases and demonstration of skills (competences)	Controlled assessment methods: Patient management problems or essay questions
Level 1: Know	Gaining knowledge through exposure to clinical cases	Controlled assessment methods: Assessment using simple knowledge tests, e.g. multiple-choice questions

Table 3: Simple Model of Competences of Miller adapted for medical sector (Competence versus performance). Source: Miller, G. E. (1990),

With regard to simulation programmes, this model is relevant as it allows measurement of skills and performance in clinical environments. The complexity of the model allows the highest level to relate to deliberate practise for the development of expertise and the necessity for retention of these skills and behavioural patterns (Norchi, 2008).

- Phillip's model:

The Phillip's Return On Investment model offers a practical method for predicting the profit potential – Return On Investment (ROI) – of a proposed training activity or human resources development initiative before the funds are committed. It focuses on the financial impact of the training, based on the Kirkpatrick approach (1996, 2007). The model contemplates the following levels:

Level	Brief description.
1. Reaction, satisfaction and planning	Measures the reaction of the participants and their satisfaction with the training programmes and participant action plans
2. Learning.	Measures improvement in skills, knowledge and attitudes.
3. Application and implementation.	Measures changes in the workplace, behavioural and implementation changes.
4. Impact on the business	Measures the impact on the business
5. Return on investment. (ROI)	Compares the monetary value of the results with the costs of the training programme.

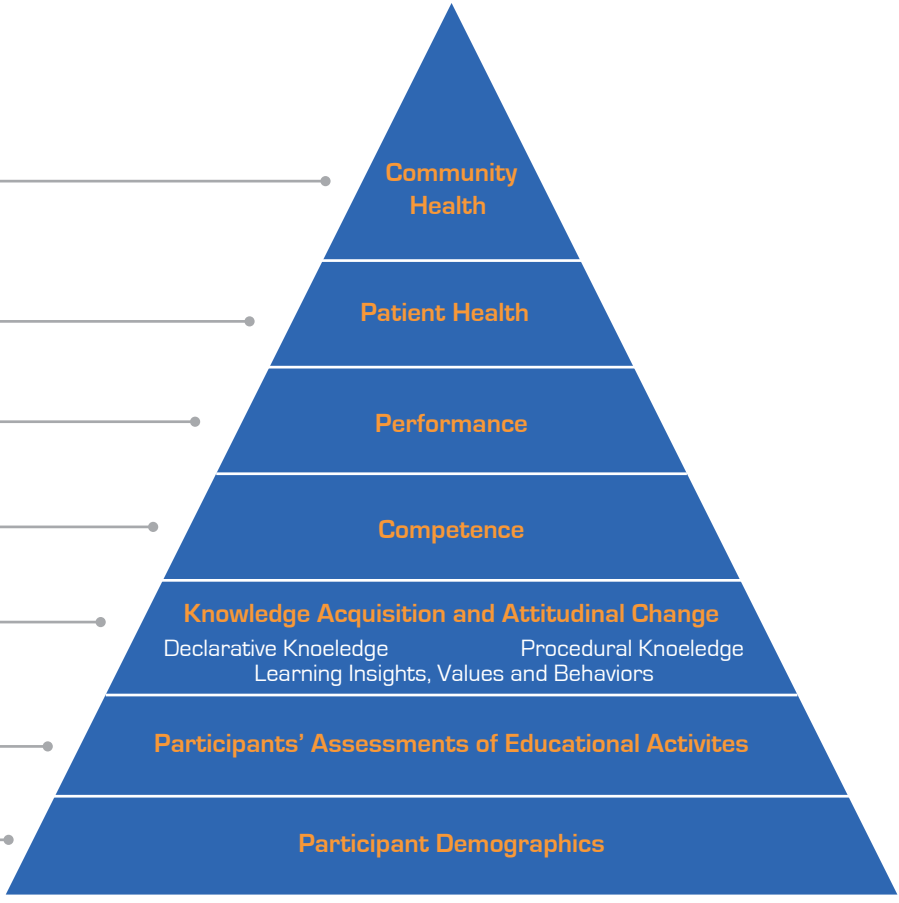
Table 4: Assessment levels. The Phillip's Return On Investment model. Source: Phillips, J. (1997).

According to this model, when a training programme is performed, a chain of impact on various levels should be created, based on Satisfaction / Planned Action and terminating in ROI. When the business results and ROI are measured (levels 4 and 5), it is important to take into consideration the other levels. A chain of impact should be created through levels. Skills and knowledge are acquired (Level 2), then applied to the workplace (Level 3) in order to produce changes in the business (Level 4). If the measurements are not evaluated on every level, it is difficult to reach the conclusion that the business results were, in effect, caused by the programme. On the other hand, if a negative ROI on the training investment, the evaluator should be capable of identifying the link(s) in the chain that is (are) broken. For example, the participants haven't learned (Level 2) or were not able to successfully apply the learning to the workplace (Level 3).

The principle disadvantage of the model lies in the fact that it tends to reduce the evaluation to financial terms, diminishing the importance of other relevant types of change within the organisation and ignoring certain elements that influence the retention and practical application of competencies acquired during the training process.

- The PRIME Model of Learning.

The PRIME ® Model of Learning was developed by PRIME Education, Inc. (PRIME ®), Florida. PRIME Education, Inc. PRIME ® was founded in 1994 as an accredited education provider for the development, implementation and evaluation of on-going education programmes for healthcare professionals.



Level 7: Community health outcomes attributable to practice changes adopted by participants as influenced by the educational activity

Level 6: Individual patients health outcomes attributable to practice changes adopted by participants as influenced by the educational activity

Level 5: Pre-activity versus post-activity measures of applications of learners' acquired knowledge and competence, assessed in the practice setting

Level 4: Pre-activity versus post-activity measures of learners' conceptual and/or practical applications of acquired knowledge, assessed in the educational setting

Level 3: Pre-activity versus post-activity measures of (a) declarative knowledge; (b) procedural knowledge; and (c) self-reported understanding, commitment to change practices, values about the educational topic and self-directed learning behaviors

Level 2: Ratings of faculty effectiveness, scientific rigor, program objectivity and the extent to which learning objectives were achieved

Level 1: Number of educational activity participants, distribution of participants by health care profession and numbers of patients treated or managed

Figure 4: The PRIME pyramid model for assessing outcomes of continuing education programs for health professionals. Source: Moore et al (2009).

Prime establishes the following learning levels for evaluation of the behaviour and learning of the participants:

Level 1: demographic information relating to the participants. The base of the pyramid represents the results for the demographic information of the participants relating to the quality and efficiency of the training activities.

Level 2: Evaluation by the participants of the quality and efficiency of the training activities: This evaluation is implemented through questionnaires in which the participants evaluate the efficiency, scientific rigour and objectivity of the study plan, as well as the skills, knowledge and experience offered by the training.

Level 3: Acquisition of knowledge and change in attitudes: In this level, the pre- and post-activity tests are used to evaluate the changes in theoretical and procedural knowledge, in other words, in the knowledge of the steps required for the performance of specific practises. Learning of these two types of knowledge are prior requirements to improvement in the competencies being developed. On this level the participants also perform a self-evaluation of learning and changes in values and behaviour (attitudes of the participants towards the subjects in question, their intention to change practises in order to bring them into line with established regulations).

Level 4: Aptitude. Competence on this level reflects the capacity of the participants to apply the competencies acquired during training to their workplace. This degree of learning may be measured either in the real-life context, or by using performance simulations, practical sessions with patients, virtual symposiums with peers, case analysis based on questions and answers, etc. Also of use are questionnaires presented 60 to 180 days after a training activity, in which the participants are asked about the frequency with which they have put the acquired competencies into practise and what new actions and interventions they perform using the acquired competencies.

Level 5: Performance. On this level we evaluate the degree to which performance in the practical environment may be measured. Pre- and post-activity tools are applied to evaluate the competencies acquired and the competencies that have been habitually put into practise in the workplace.

Level 6: Patient health results. This level proposes monitoring of the results in patient health using information from clinical histories.

Level 7: Results in population health. The final objective of the model is to evaluate the repercussions of the training on the health of the population, with all the design complexity and information availability that this supposes.

- The Holton model.

The Holton model is centred on analysis of the variables that influence the transfer processes, beginning with the idea that the transfer can only be completely understood and influenced by examining the entire system of influences. This is

the reason for measuring the constructs proposed in his model, which comprises 89 questions, grouped into 16 factors, making up an instrument of measurement called the Learning Transfer System Inventory (LTSI).

The purpose of the Learning Transfer System Inventory (LTSI, Holton et al, 2000) is to assess the 'transfer system', in other words 'all factors in the person, training and the organization, that influence transfer of learning to job performance' (Holton et al., 2000). This instrument has been tested with strong evidence of the validity of constructs (Yaghi, 2008; Devos et al, 2007; Chen, 2005; Khasawneh, 2004) through statistical analysis, measuring the influence of the variables in the different domains covered by the model.

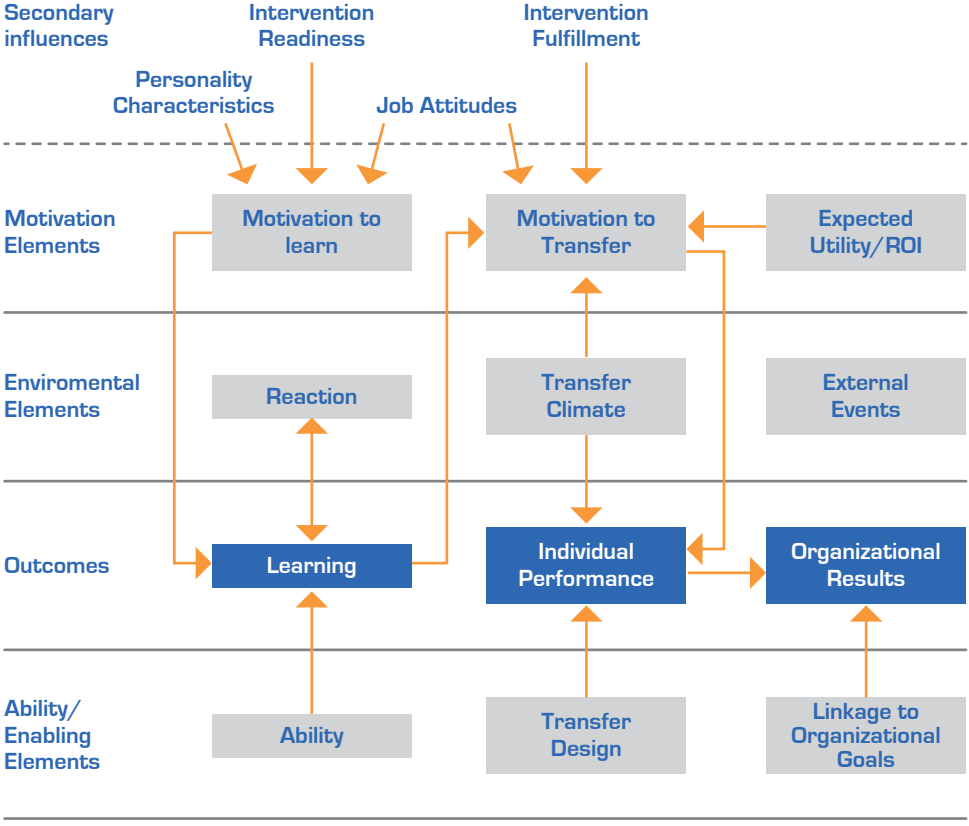


Figure 5: The Holton model. The transfer of training. Source: Holton (1996).

The model basically considers three groups of factors: 1) motivation; 2) the working environment and, 3) individual capacity and other support elements.

Regarding motivation, the following factors are taken into consideration:

- **Expectations for performance resulting from transference efforts:** expectations that the efforts made in learning will bring about changes in job performance.
- **Results of performance expectations:** expectations that the changes in job performance will bring about positive results.
- **Disposition of the individual towards learning:** the degree to which the individuals are prepared to participate in the training
- **Transference motivation:** focus, intensity and persistence of efforts to employ the skills and knowledge learned.
- **Self-efficacy:** the perception of the individual regarding their capacity to change their behaviour whenever they wish.

With regard to the working environment, factors included are:

- **Positive personal results:** the degree to which training application in the workplace leads to positive results for the individual.
- **Negative personal results:** the degree to which the individuals believe that non-application of the skills and knowledge acquired through training will lead to negative personal results.
- **Co-worker support:** the degree to which co-workers reinforce and support the use of competencies acquired in the workplace.
- **Supervisor support:** the degree to which supervisors and directors reinforce and support the use of competencies acquired in the workplace.
- **Resistance or openness to change:** the degree to which existing regulations in the group are perceived by the individual as resistance, or do not advise the use of competencies acquired in training.
- **Training performance:** formal and informal organisational indicators regarding individual performance.

Regarding individual capacity, the following factors should be considered:

- **Personal capacity for transference:** the degree to which individuals have the time, energy and focus during their working day to make the changes required to transfer learning to the workplace.
- **Perception of content validity:** student opinion regarding the degree

to which the training content provides a response to workplace requirements.

- **Training design for transference:** the degree to which the design and provision of the training enables the student to transfer learning to the workplace, and to which the instructions received during training coincide with the workplace requirements.
- **Opportunities for use of the acquired competencies:** the degree to which students may obtain, or already possess, tasks which allow them to apply competencies acquired in training.

The model, never the less, has limitations that should be taken into consideration. The author himself admits that the model only describes a series of influences that are exercised on a single training experience and does not include feedback loops. For example, while learning success may increase future motivation, this possibility is not included in the model. Other factors lacking in the model are indications of interaction between factors of the same type, such as organisational factors. For example, there is no indication whether supervisor support, mutual support or resistance to change are separate factors or whether they are related.

Impact evaluation experiences in simulation-based training

The majority of conceptual frameworks for evaluation of the results of simulation-based learning are based on five fundamental aspects:

a) increased knowledge and understanding,

b) higher levels of satisfaction,

c) increased skills performance,

d) development of critical thinking skills,

e) increased self-confidence.

Despite the many benefits associated with simulation-based training, the truth is that evaluation and validation of transfer and impact have not been well documented and much work is required if we are to be able to measure the degree to which simulation-based learning results lead to real application in the workplace.

From a conceptual perspective, a practical framework proposal has been identified for the evaluation of the impact of clinical simulation experiences in pre-licensure nursing education in the magazine Clinical Simulation in Nursing (Prion, 2008), in which an approach based on logical modelling (input-environment-outcome) assumes measurement and evaluation of impact from the point of view of processes that are applicable to clinical simulation experiences. Next figure shows the dimensions and variables of the model, for which a series of validated simulation-evaluation tools have been documented.

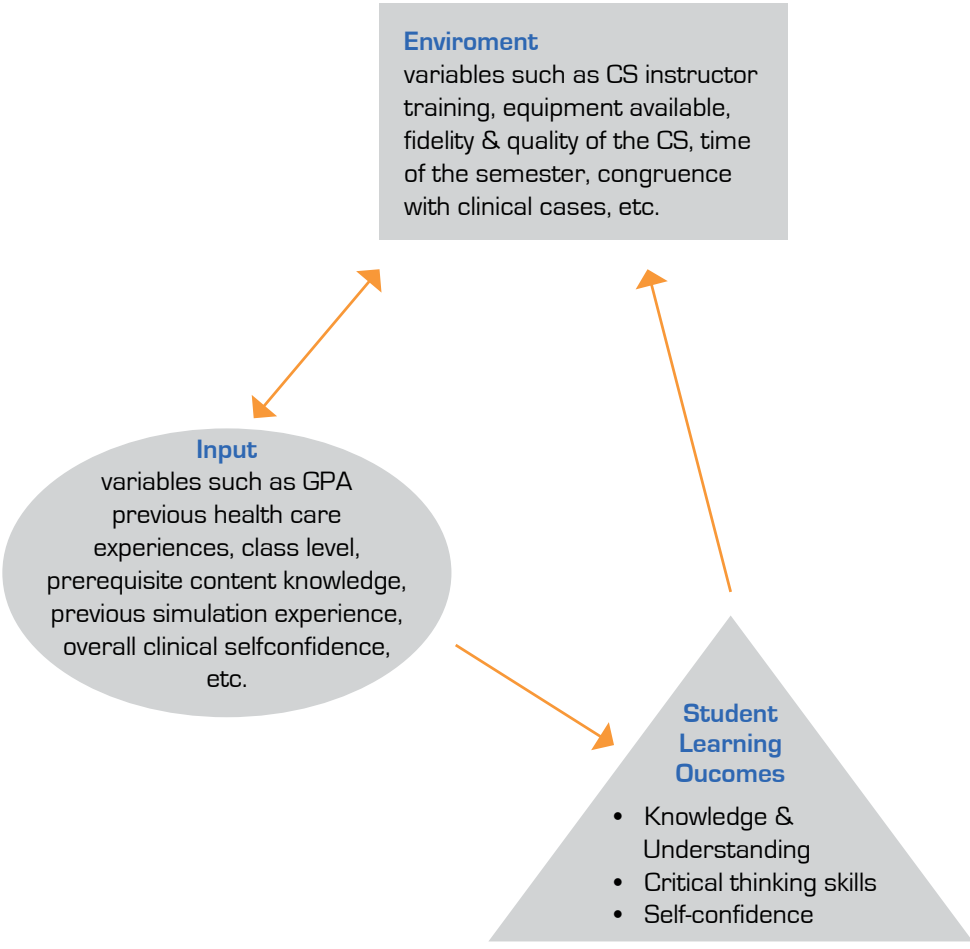


Figure 6: Astin's input□environment□outcome model. Note: CS - Clinical Simulation; GPA □ Grade Point Average

Another simulation-based learning model is that proposed by Jeffrey (2005), which takes into account the entire simulation management cycle up as far as results evaluation as well as the factors leading to the success of these learning results. Fig. 3 shows the relationship between the constructs proposed by the model that have been validated by posterior case studies. This model constitutes an interesting reference point for our proposal.

The majority of studies are focused on quantitative methods for long-term evaluation of the results of simulation-based training within the educational environment itself. This is the case with Kuduvalli et al (2009), where statistical methods are used to evaluate the retention and transference of resource management skills in emergency anaesthesia teams using high-fidelity simulation-based courses, demonstrating that the skills trained were both retained in the long-term and transferred to other clinical activities.

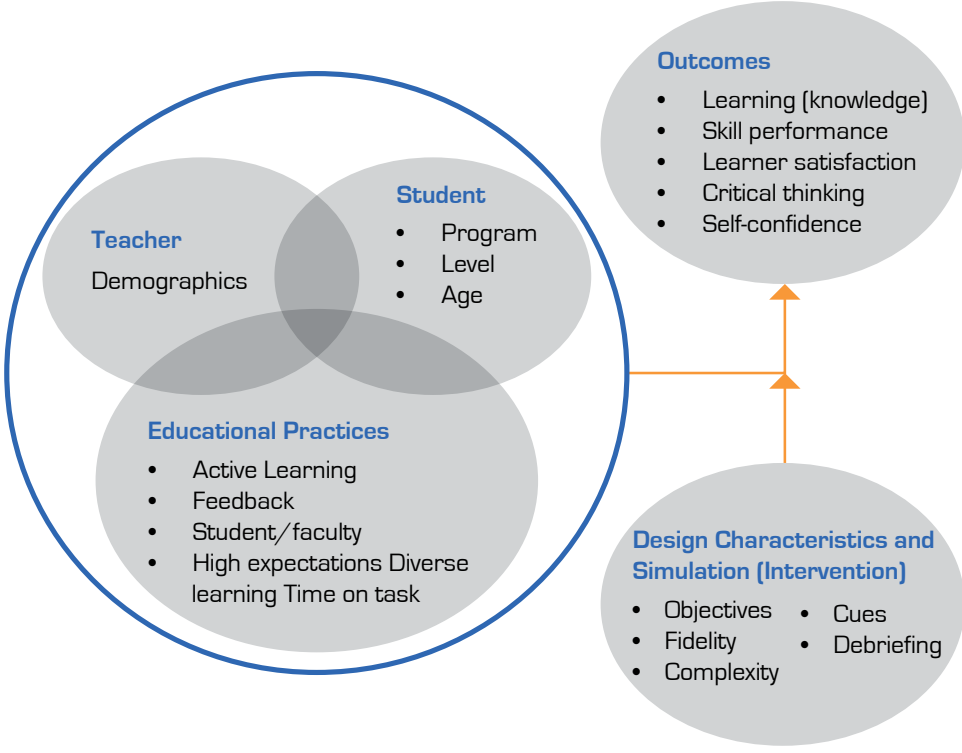


Figure 7: Simulation model. Source. Jeffrey (2005).

Other studies that could quantify the behavioural changes in the workplace, however, may be more useful. McCaughey and Traynor use a mixed approach to perform an analysis from the students' perspective of the role of simulation in nursing training through a series of questionnaires, the results being an affirmation of the constructive influence of simulation in clinical practise.

A number of other studies have demonstrated the increase in self-efficacy gained through simulation-based training. Chlan et al (2008), for example, examined the impact on an experimental section of nursing students. Pre-test and post-test analyses demonstrated an increase in student self-efficacy in the practical performance of these skills. Other studies, such as Leigh (2008), Bandura (1986, 1997), Sinclair and Fergusson (2009), have also demonstrated the effects of simulation-based training on increased self-efficacy.

Some investigations have demonstrated the effects of simulation on the improvement in student confidence in skills mastery. A multi-centre pilot study in the UK showed that simulation increased student confidence in the practise of clinical area skills (NMC, 2007). Another study in Tasmania performed a qualitative investigation of student perception of clinical simulation, showing an increase in student confidence as a result of clinical simulation coupled with greater confidence in clinical implementation, a result which would suggest transfer of learning (Reilly and Spratt, 2007).

Regarding evaluation tools, some of the identified experiences (Alinier et al, 2006), examine the institutional impact of clinical simulation using information gleaned from self-reports on the affective variables such as satisfaction and self-confidence. These would appear to be the most widely used tools. Measurement of just these variables, and in isolation, however, would be an incomplete evaluation of the simulation experience. Indirect information, such as change in competency use in the workplace, or improvements in patient care services due to the use of simulation technologies, are more difficult to evaluate as they require in-situ demonstration, or observable changes in participant behaviour. These cases require the use of a variety of types of tool (self-reports (students), reports by others (co-workers, supervisors, instructors) which reflect the changes that occur, leaving it to the evaluator to triangulate the results.

Simulation-based training encapsulates an inherently complex framework that must be reflected in the evaluation of the results obtained, the transfer to clinical practise and the design of the tools required. This is due to the fact that the student must be capable of realistically putting into practise a number of different skills in one, single space. Regarding this, Prion (2008) affirms that...

The potential instructional advantage of clinical simulation for the students is the opportunity to realistically combine everything. In other words, to integrate clinical skills, knowledge, multi-disciplinary communication, evaluation, critical

thinking and a variety of other skills, in real time, in a clinical situation

On the other hand, simulated training is a training activity that is developed in an organisational and educational context where simulation exerts an influence on the results of the activity. Isolated analysis of certain categories of results may be incoherent or, in any case, untrustworthy, if the aim is to evaluate more than just the improvement in competencies of the students. Evaluation of the real and potential effects of simulation-based training in healthcare and in the organisation requires evaluation design that focuses on the processes and which takes into consideration, assumes and integrates the relevant information from the training processes from the initial planning stage up to the final, long-term evaluation stage.

We should not be so naive as to believe that simulation alone will have a significant impact or improvement in the healthcare communities. The perception of changes that may occur in clinical practise as a result of simulation may be influenced by a multitude of environmental and personal factors that affect transfer, and indeed the credibility of the measurement in itself. Analysis of variables such as, motivational aspects, organisational capacity and support, working environments and availability for transfer is a core aspect to be taken into consideration in the design of simulation-based training impact evaluation. This type of analysis should be integrated coherently with the other evaluation tools in order to provide the most complete description possible of the legacy of simulation-based training activities. This allows us to approach, albeit qualitatively, a suitable means of sharing responsibility for the successes of the training activities.

In order to avail of a coherent, comprehensive and realist evaluation of simulation-based training, it is important, and this is one of the assumptions of this proposal, to develop strategies which allow for the development of evaluation tools, bearing in mind the characteristics of the training event, from the process-focused planning stage, as well as the multiple environmental and personal factors and the ambiguity that often accompanies the measurement of all these complex, inter-related variables.

2.3.1 Key problems in training impact evaluation

Impact evaluation, contrary to other dimensions in training evaluation, and despite its approach through a variety of scenarios and practical experiences (cite), is considered to be lacking in the same methodological basis for objective evaluation and the same assurance as other, more immediate results, such as reaction evaluation (satisfaction) or results evaluation in the strict sense of the phrase, i.e. increase in competencies, knowledge, skills.

In order to evaluate the effects of a training programme one is obliged to wait a certain amount of time for the acquired competencies to be given practical application in the workplace, a factor that has specific effects on both the trainee and

the organisation in which the knowledge and skills are applied. During this waiting period, or even before commencement of the training programme, during the development stage, a series of factors may come to bear that complicate the task of attributing possible changes to the training programme or to any of the other factors mentioned above. These are commonly known as attribution problems, or gaps, and constitute one of the greatest challenges in impact evaluation. The principle problem in impact evaluation, then, is determining to what degree the training has contributed to the observed changes.

Simulation-based training programmes are also subject to this type of methodological problem. The reality of clinical practise is enormously complex and, as far as possible, the evaluation models and tools must attempt to reflect all the factors that may, in one way or another, affect the outcome.

In relation to simulation programme evaluation, this aspect has been very poorly documented and practical evaluation tools are generally applied during the debriefing phase and shortly afterwards in order to evaluate the obtained results.

It is worth clarifying that, while these attribution problems are also evident in simulation programmes, the fact that simulation itself, as an educational methodology, provides greater possibilities for practical application of the acquired competencies, becomes an element that is favourable to transfer and, as such, also favours the probability that these training programmes will produce benefits in comparison with more traditional training methods. This is an aspect that favours simulation evaluation models and should be given suitable consideration in the design of the respective proposals and measurement tools.

We should, however, consider possible evaluation methods which, on the one hand, minimise the effects of possible internal and external factors on the organisation and on the individual and, on the other hand, help determine the influence exerted by certain factors that have been considered in the model as well as others that have not previously been considered.

The more commonly used, and documented, methods relating to the evaluation of training programmes in general are those described in the table below:

Methods	Description
Experimental, or quasi-experimental design	This type of design requires the formation of comparison groups and, ideally, measurement before and after the training. The groups to be compared should be homogenous with regard to certain variables in order to facilitate 'isolation' of the degree to which the effect may be attributable to the training. One or more groups may intervene, but at least one group should not be affected in order to act as a control group.
Wide-ranging consultation	Questionnaires and interviews using representative samples (useful for analysing causal relationships)
Traceable methods.	Inspired by case studies. Step by step monitoring of the chain of events and the apparent causal links between them (workshops). Limited to identification and listing of possible causal or influential factors (favourable and unfavourable)
Reasonable combination of evaluation methods	A reasonable combination of complementary methods would provide a more complete perspective of the complex reality of attributing a specific effect to a training event.

Tabla 5: Impact assessment methods.

3 MODEL DESCRIPTION

This proposal responds to the objectives and requirements of the European SIMBASE Project, which promotes the use of ICT-aided simulation in healthcare centres. The objective of the evaluation model is, first of all, to serve as a conceptual and support framework for the evaluation of whether or not implementation of simulation in healthcare centres is effective and efficient and, secondly, to evaluate whether or not simulation is used in such a way that it increases the quality of the learning process in a manner that is both coherent with, and integrated into, the student and professional learning itineraries.

We do not propose to evaluate the effectiveness of simulation in healthcare training as this has already been extensively documented. Our proposal is to evaluate whether or not implementation and use in healthcare centres is oriented towards greater impact on the individual, the centre, and the community.

For this reason, the model represents both a conceptual framework and a tool for use by those responsible for the administration of health and education policies who, naturally, are concerned with evaluating the impact of decisions regarding the organisational implementation strategy for maximising the benefits of simulation-based training on the levels mentioned (individual, organisational and community) and the corresponding management elements that must be taken into consideration.

The proposed model is based on the fundamental premise that the success of implementation depends on the close relationship that is established between the strategy and the context, as well as on correct detection of the organisational, community health and professional competency requirements and coherence and alignment with the overall organisational development strategy within which the training activities are developed.

On many occasions, the primary healthcare requirement that is the initial reason for the design of a training activity to develop a particular professional competency gets lost during the planning and design phases. We must emphasise the importance of seeking a direct effect by prior identification of indicators for health, patient safety and clinical variance in such a way that the end result of the learning process is present in all stages of planning, design and performance of the training activities.

In order to achieve this, we propose an

evaluation approach that is focused on quality management of the simulation-based training processes. We will be studying the more relevant aspects from the initial planning phases of the training through to the implementation and posterior monitoring phases, thereby allowing for integration of evaluation into all the key categories relating to simulation results. It is taken for granted that isolated evaluation of categories using the corresponding evaluation tools does not allow us to capture and evaluate of the inherent complexity of a training strategy of this type.

Bearing this in mind, the proposal is focused towards evaluation of a quality management model for implementation and use of simulation-based training that, in turn, is based on the evaluation of the different processes and the coherent, balanced integration of the different levels of learning evaluation along with the corresponding variables and indicators. The model also proposes identification of the various actors involved and their roles, as well as the importance of performance of these roles for the success of the process. Descriptive tables, along with the corresponding evaluation tools, have been designed for each of the fundamental levels of learning evaluation.

On a final note, the model has been developed bearing in mind the role of the evaluators and, as such, identifies the most appropriate moments in which to apply the evaluation tools and whether or not they should be applied more than once. The model suggests the optimum moments to gather information during the activity and, finally, performs an analysis of both the requirements for the practical application of the training as well as the management evaluation requirements for the model.

There are a number of significant problems in attributing the success of individual, organisational and community results to one particular fact, or variable, or, indeed, in quantifying their influence on the results. Faced with this difficulty, we believe the solution is to combine a series of perspectives into one integrated vision of the process, providing us with more realistic knowledge of the process and, what is more important, providing us with an necessary decision-making tool.

3.1 Scope and objectives

The scope of this evaluation model, with regard to the unit under evaluation, is especially oriented towards training programmes, plans, or strategies. The dimensions and indicators may, however, depending of the training objectives, be applied to individual simulation experiences.

With regard to impact, the evaluation may approach three fundamental areas: individual performance, to analyse the effects of the simulation experience on the healthcare professional in the medium and long term; organisational performance, to evaluate the improvement in specific

results indicators within the organisation due to the development of simulation-based training programmes; and community health results, to evaluate large scale indicators over a longer time period.

The objectives of this proposal, therefore, are to:

- Provide a conceptual framework for evaluation of the effects of simulation-based training within the context of the organisation.
- Serve as a support for the development of a pilot guide with all tools, for the application of the evaluation model for an implementation strategy that allows for the validation of the complete range of evaluation tools.

3.2 Methodology

a. Literature review

Initially, an extensive examination of publications was performed in order to (I) provide us with a suitable foundation for the acceptance of simulation as a strategic training methodology, (II) acquire extensive knowledge of training evaluation models in general and, in particular, training impact evaluation models for healthcare professionals, (III) analyse the results obtained in documented experiences of simulation evaluation and select the critical success factors for simulation implementation in healthcare and education centres.

Upon performance of an extensive review of international databases relating to research on simulation-based health professionals education, approximately 1300 articles were found, from which the 50 most quoted on an international level were selected for analysis. Among these there are some which stand out for their particular relevance, such as those published by Issenberg and McGahie (2005; 1999), Epstein and Ronald (2007), Ziv et al. (2003), Bradley (2006), etc. Special emphasis was placed on the analysis of reviews of meta-analytical publications which provide relevant information about the best practises and critical success factors of simulation as well as possible tendencies in simulation-based training up to the year 2020 (Gaba, 2004; Issenberg and McGahie, 2005; Fessler, 2012, Bradley, 2006 and McGahie 2006, 2009, 2010 and 2011).

Strategies and recommendations provided by international organisms regarding the quality of training in general and, in particular, the training of healthcare professionals, were also reviewed (ISO/IEC 19796-1; WHO, 2012; WFME, 2012, Lindgren and Gordon, 2012; Grant, 2011).

b. Piloting the impact evaluation model of the SIMBASE Project

The SIMBASE Project has piloted a simulation-based training impact evaluation model which employs both a diachronic perspective of the entire training process based on the ISO model, as well as the integration of a variety of perspectives

based on examination of the variables and tools employed in other impact evaluation models. The models selected were specifically those which emphasised the critical factors relating to the surroundings in which the training takes place, the training requirements detection methodology, and the culture of the organisation.

The constituent committee for this project comprises many different profiles, providing a polyhedral perspective on the problems of implementation and dissemination of this type of learning, a characteristic that has made us more aware of the relevance of these factors.

Training providers from different training stages have intervened in this pilot, including graduate medical students, medical training specialists and professionals from on-going nursing training. Coordination was maintained between an expert training innovation centre, Iavante's CMAT centre, in Granada, and a public healthcare administration, the Ministry of Health and Social Welfare of the Regional Government of Andalusia, the latter providing the perspective of a public healthcare body, the principle receiver of healthcare professionals, and therefore jointly responsible for their training.

c. Peer review

The document presented is the version performed after peer review conducted in the first version of the model, Deliverable D.2.1 SIMBASE Project. Validation results allowed the proposed remodel, getting a clearer picture of the relationships between concepts, adding new ones, and consistent model simplification to try to get a more practical and likely to be used in reality.

d. Workshop on Impact Assessment experiences of training health professionals in the health system in Andalusia.

This workshop was developed in collaboration with the Andalusian School of Public Health (Pinzón and Escudero, 2012), with which the staff of the Ministry of Health, had collaborated in the development of a proposed impact assessment model for complementary training program specialists developed in Andalusia since 2002. The workshop also reviewed and discussed the impact assessment tools used by the Agency for Health Quality of Andalusia (ACSA, 2013). Relevant findings were obtained for the final draft of this document.

e.. Main assessment elements.

The result has been development of a model based on consideration of the following closely-related elements for performance of evaluation of the principle results of simulation-based training activities through evaluation of the:

Learning level results: These levels were defined with the knowledge that provided the analysis of the revised models and considering the objectives of our proposal. It identifies the fundamental assessment levels of learning outcomes, allowing integrating into measurement the major critical success factors in the implementation of the simulation. General

assessment levels are selected:

- Initial evaluation or diagnosis
- Evaluation of satisfaction
- Evaluation of transfer and practical clinical behaviour
- Evaluation of impact on trainee's performance, the organisation and the healthcare community results.
- Simulation profitability (ROI)

Critical success factors for implementation of simulation-based learning: In order to evaluate whether or not simulation guarantees both results that are transferable to clinical practise as well as impact on the individual, the organisation and the community, it is necessary to incorporate factors favourable to the success of this transfer and impact into the evaluation process, thereby enriching the evaluation model with factors relating to the clinical, organisational and educational contexts. Selection of these factors was performed on the basis of extensive documentary examination as well as the factors ultimately recommended by the SIMBASE project in the context of their programme and as a result of the piloting experience performed.

The actors involved: For the design and application of evaluation tools that allow us to gather both direct and indirect information, the various actors involved in the simulation sub-processes and in the transfer to clinical practise have been taken into consideration, as well as their potential impact at different levels.

Dimentions and indicators: Appropriate evaluation variables and indicators have been selected to measure each of the learning results levels.

Our intention is to achieve coherent integration of this complexity into an easy-to-use operational proposal that takes into consideration the factors that, from a clinical, educational and organisational context and from the point of view of the trainees themselves, may affect trainee performance, the application of simulation-acquired competencies to clinical practise, and the subsequent impact.

3.3 The SIMBASE model for impact evaluation of simulation-based training.

The proposed model allows us to evaluate whether or not simulation has been integrated as part of the strategy and objectives of the organisation, bearing in mind any possible obstacles or facilitating elements that may be encountered during the evaluation. It includes, therefore, an approximate analysis of the critical success factors that affect development of the training activities, transfer of the content to 'real-life' situations and the potential impact. Analysis of these factors during the evaluation will help us to provide a response to complex issues such as attribution, while allowing us to identify the true effects of the training activity with clarity and precision.

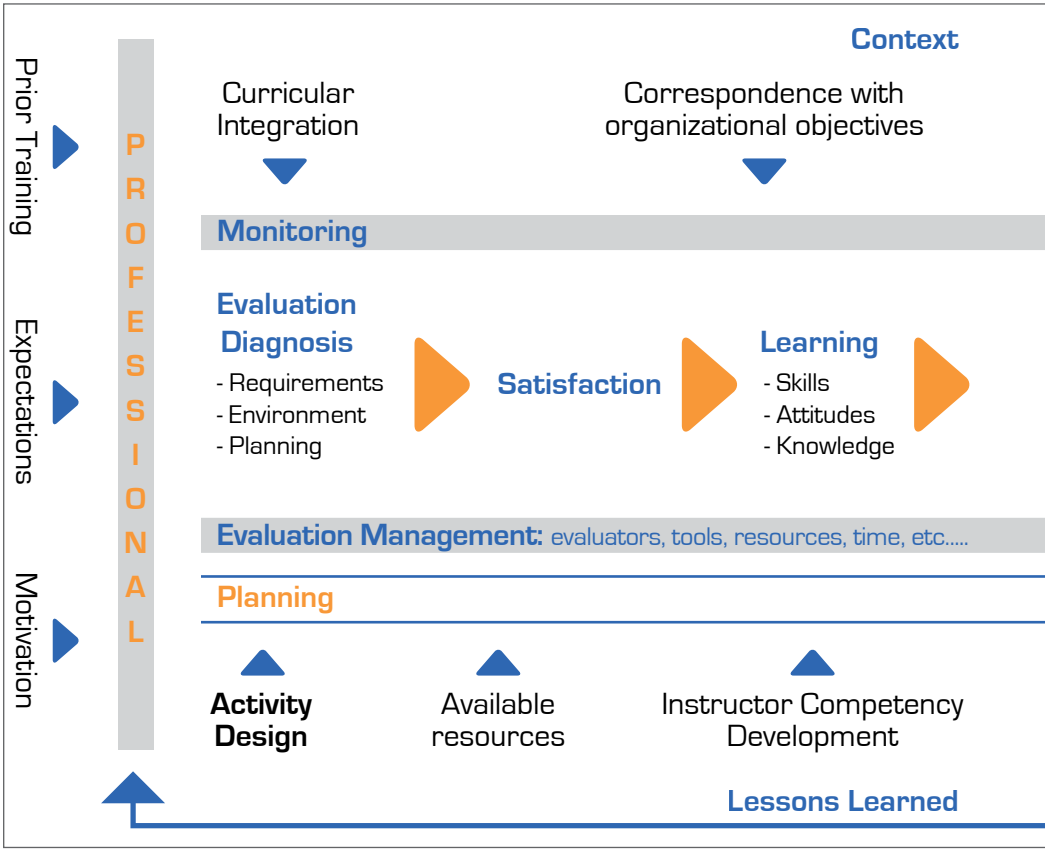
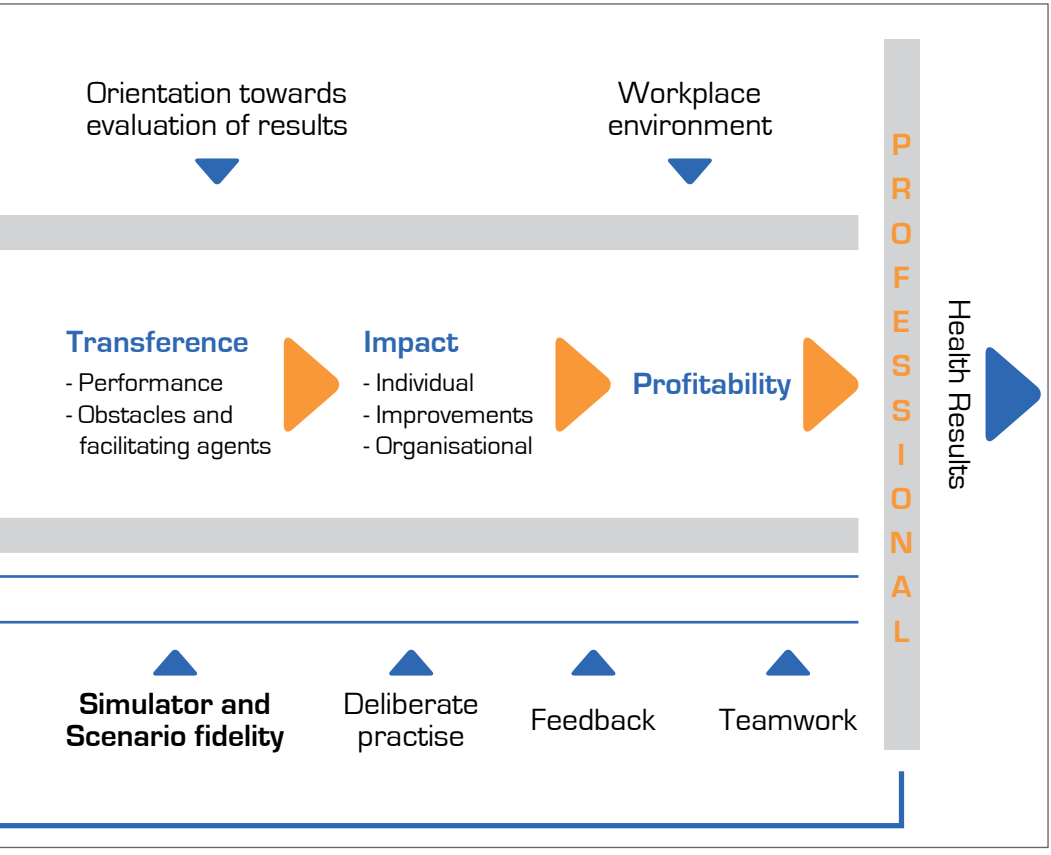


Diagram: The SIMBASE model proposal.

Below, as the central theme of the operating evaluation process, we shall describe the principle levels of simulation-based learning results that, in conjunction with the initial evaluation diagnosis, which should be incorporated at the beginning, constitute the evaluation levels for our proposal, this being the initial process required for coherent measurement of the changes that are attributable to the dynamics and complexity of the learning processes and, as such, the long-term effects of these on the individual, organisational and (in the central part) sectorial spheres.

The upper section shows the critical contextual factors which will be analysed as strategic processes for the success of the evaluation

The lower section shows the critical factors relating to the planning and training activity design which will provide the support required for the evaluation.



The central section, the core results to be evaluated, contains references to the importance of the evaluation management model described in the proposal.

Bearing in mind the complexity of the clinical context and the number of factors that may affect the results of simulation-based learning, this model manages to incorporate all those factors that constitute critical aspects for the success of simulation in clinical practise. Analysis of these factors is performed simultaneously in each of the evaluation levels where they may exert some influence.

Below we shall provide a description of the model, beginning with the initial evaluation, and followed by evaluation of the various learning levels.

3.3.1 Initial evaluation

An isolated evaluation of the simulation experience learning results and their effects on the participants, the organisation and the community, that does not take into consideration relevant information prior to the training activity, may be considered as incomprehensible. First of all because it is necessary to capture the complexity of the clinical contexts and the influence of individual characteristics, such as prior training, prior experience in simulation, motivational aspects or demographic characteristics, and, secondly, because we need to know the initial situation in order to be able to identify the subsequent changes that take place.

We will identify the training requirements in order to perform a subsequent analysis of whether or not they were complied with and to what degree. We shall also identify the degree of motivation of the trainees, as this may have repercussions on their progress, satisfaction and the degree of learning acquired. To evaluate the effects in terms of evolution, or improvement with respect to the initial situation, much of the information gathered may be used in 'before and after' comparison measurement tools.

Prior analysis of the organisational context, however, may be relevant with regard to both orientation of the design of the training activity as well as for identifying factors that may be considered as either obstacles or facilitators for learning, transfer and impact. Analysis of the organisational context may also provide information regarding the degree of relevance of simulation experience for the organisation and identification of the organisational requirements to which it may provide a response.

In this initial phase, analysis of the following dimensions is proposed:

Regarding the trainees

- Prior training: prior experience in simulation, level of knowledge of course content.
- Demographic profile: age, sex, country of origin, information on the centres where the competencies will be applied.
- Motivation and expectations: interest in the training to be received, expectations regarding simulation as an educational methodology, etc.
- Competency requirements: knowledge, skills and attitudes.

Regarding the organisational/laboral context

- Workplace context: health requirements, relevance of the training event, coherence with organisational objectives, workplace, etc.

Regarding the educational context

- Educational context: Curricular integration.

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>1.1</td><td>Initial evaluation</td><td>Professional profile</td><td>Demographical and professional information on the trainees useful to clinical simulation</td><td>Prior to the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">Identify relevant information about the trainee and instructor profiles that constitutes initial analysis of simulation-based training results..</td></tr>
<tr><td colspan="3">Evaluation techniques: Survey</td><td colspan="2">Evaluation tools:
Initial questionnaire for the participant
Initial questionnaire for the instructors</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Instructors</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">For Trainees:
• Demographic profile: Age, sex, country of origin, data workplaces where competences apply.
• Prior training: a) Prior healthcare experience, b) General level of knowledge and understanding (GPA = Grade Point Average), c) Prior knowledge of simulation scenario content, d) Prior skills regarding simulation scenario content, prior attitudes regarding simulation scenario, e) Perceptions of prior experience of clinical simulation (positive and negative), e) Self-confidence levels of trainees regarding content and required skills for the simulation scenario.
• Information on the centres where competencies may be applied: Name of centre, region, clinical work/study area etc.
For Instructors:
• Prior training: experience in simulation, degree of experience in simulation scenario content, training
• Workplace information: Name of centre, region, clinical work/study area etc.</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>1.2</td><td>Initial evaluation</td><td>Motivation and expectations</td><td>Motivation and expectations regarding the usefulness of simulation and the training experience</td><td>Prior to the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Identify relevant information about the motivation and expectations of the trainees and instructors, constituting an initial analysis of simulation-based training results.

• Evaluation of the usefulness of simulation as an educational methodology.</td></tr>
<tr><td colspan="3">Evaluation techniques: Survey</td><td colspan="2">Evaluation tools:
Initial questionnaire for participants.
Initial questionnaire for instructors.</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Instructors</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">Trainees and instructors:

• Personal interest in simulation experiences

• Personal interest in the clinical speciality of the simulation

• Evaluation of the usefulness of simulation as an educational methodology.</td></tr>
</table>

ID	Process	Dimension	Description	When to perform the evaluation.
1.3	**Initial evaluation**	Competency requirements	• Skills and transversal competency training requirements of the trainees. • Specific training requirements	Prior to the simulation experience
Objective			• Identify relevant information regarding the competency requirements of the trainees that constitutes an initial analysis of simulation-based learning results. **Instructors** • Identify relevant information regarding the competency requirements of the instructors as an initial analysis of instructor training requirements	
Evaluation techniques: Surveys, feedback reports, simulations			**Evaluation tools:** Requirements and expectations questionnaire. Self-evaluation using competency map. Previously defined best practises. Prior evaluation. Video recording.	
Profiles included in the evaluation			• Trainees • Superiors • Instructors	
Dimensions and Indicators			• Competency requirements to be developed by the trainees during the training: perception of the trainees regarding the skills, knowledge and attitudes to be trained in this type of training. Perception of the superiors regarding the skills, knowledge and attitudes required by the trainees with regard to their workplace. • Competency requirements to be developed during the training, by professional and demographic profile • Competency requirements of the instructors. Instructors perception of the skills, knowledge and attitudes that they should and do not possess in order to provide suitable supervision of the training activity. • Perception of the possibilities for deliberate practise by the superior and the trainee. Trainee and superior perception of the need to repeat the technique in the workplace.	

ID	Process	Dimension	Description	When to perform the evaluation.
1.5	**Initial evaluation**	Organisational context	• Characteristics of the organisational and educational context that may influence learning results and their evaluation.	Prior to the simulation experience
Objective	• Identify and evaluate the characteristics of the organisational and educational context that may influence learning results and their application. • Identify information regarding clinical variance • Identify information regarding patient safety indicators (number of existing errors in the work environment related to the competency to be trained)			
Evaluation techniques: Panel of experts, surveys, interviews, examination of documents	**Evaluation tools:** Initial questionnaire for participants. Register of interventions by panel of experts Register of activities, results and health indicators in the organisation.			
Profiles included in the evaluation	• Supervisors/managers/clinical unit supervisors/university department directors • Experts (include aspects relating to organisational and educational context in trainee and instructor questionnaires)			
Dimensions and Indicators	• Health requirements: Identified health indicators to which training may provide a response. Clinical variance and patient safety indicators • Relevance of the training event. Perception of the relevance of the event • Links to organisational objectives: Perceived alignment of the training with strategic management and the objectives of the organisation. Knowledge of the organisation's strategic management about the training event. Commitment by the strategic management of the organisation. • Curricular integration: degree of relationship of the training event with curricular plans and actions developed to promote curricular integration of simulation experience with trainee practises. • Orientation of results evaluation: institutional policies to promote evaluation of results, degree of relationship of the measurement strategy of the results of the simulation-based training with the organisational objectives. • Workplace: organisational environment, support by superiors and co-workers for application of competencies to clinical practise, etc. • Expectation regarding the possible benefits of the learning, or training activity in the organisation. • External events. Sudden changes in institutional strategy, financial or organisational.			

ID	Evaluation level	Dimension	Description	When to perform the evaluation.
1.5	**Initial evaluation**	Investment in the learning or training activity	• Report on the costs associated with the simulated training activity	Prior to the simulation experience
Objective		• Analyse the investment in simulation-based training to calculate the profitability of the training activity in the corresponding phase.		
Evaluation techniques: Analysis of return on investment			**Evaluation tools:** Financial reports. Documentation. Interviews.	
Profiles included in the evaluation		• Healthcare and education centre management • Course administrators.		
Dimensions and Indicators		• Direct costs: instructors, equipment, other materials, space, instructor and trainee expenses, loss of trainee work days • Indirect costs: management, design, administration, communications, additional materials, participant wages, etc. • Structural costs: general organisational services, such as supplies, cleaning, depreciation, repayments, etc. • Total simulation costs. • Estimated costs of the errors for which competencies are being trained. Information relating to: • Cost of the trained healthcare competency (costs associated with operating complications, number of avoided incidents, costs of compensation, etc...) • Costs associated with simulation hours per phase: • Costs associated with the number of participants • Costs associated with the total number of simulations • Costs associated with inactivity time • Costs associated with the number of visitors • Costs associated with the processes implied in obtaining the expected changes: • Changes expected for calculation of ROI.		

3.3.2 Satisfaction

Evaluation of satisfaction and reaction subsequent to a training activity is a widely used method of ascertaining whether the perception of the quality of the activity has been positive or negative.

With regard to simulation experiences, participant satisfaction is generally associated with subsequent participant performance, to the extent that complementary evaluation tools are generally employed. Satisfaction may be measured both quantitatively and qualitatively. What is important in either case is to measure the trainee satisfaction with respect to the simulation-based learning experience and integrate it as a sub-process in the overall evaluation of the learning results.

Some studies propose different types of tools, such as the 20-item Simulation Design Scale (SDS) developed by NLN/ Laerdal to measure constructs proposed by the Jeffries (2005) simulation model. Others advocate more in-depth questions as a complementary element to these questionnaires in order to perform a more qualitative analysis, as "What were the most useful aspects of simulation?, allowing students to respond in-depth (Prion, 2008).

Our proposal also includes some critical success factors for simulation that are included as key variables in the results with a view to analysing the perception of the trainees regarding the quality of the simulation experience and other relevant factors.

For evaluation purposes, a Likert-type scale for the measurement of the attitudes, similar to that employed in the piloting of the SIMBASE project, is proposed. The proposed version differs from that used in the SIMBASE project, however, by the inclusion of analysis of other variables relating to factors relevant to the success of simulation, such as deliberate practise, the characteristics of the scenarios or simulators, or the environmental conditions, all of which influence the learning results, as well as other factors such as the possibility of team learning or the competency of the instructor. The evaluation includes open questions which require a qualitative analysis, with the aim of obtaining a more elaborate, in-depth feedback from the trainees and instructors.

ID	Process	Dimension	Description	When to perform the evaluation.
2	**Evaluation of Satisfaction**	Satisfaction and reaction	• Perception of satisfaction of the trainees with simulation-based training activities.	On conclusion of the simulation experience.
Objective		• Evaluation of the satisfaction of the participants and instructors with the training activity including questions relating to the possibility of deliberate practise, the characteristics of the scenarios and simulators, environmental conditions, the possibility of team learning, etc. • SBL training outputs		
Evaluation techniques: Surveys			**Evaluation tools:** Questionnaire regarding satisfaction with the training activity (open questions) Check List of Main Dimensions in the Simulation Application	
Profiles included in the evaluation		• Trainees • Instructors		

Dimensions and Indicators	• Pertinence: the simulation experience responds to the needs and expectations • Prior information: sufficient prior information was received to adapt your expectations to the real content of the module • Usefulness: the module provides knowledge and develops skills that are applicable to clinical practise • Quality of the course design: perceived quality of the simulation activity, correspondence of objectives with content, quality of planning of the activity • Available resources: sufficient number and variety of resources, simulator fidelity, etc. • Deliberate practise: possibility of repeating the technique during the session, levels of difficulty, degree of concentration adopted, perception of degree of dedication to the activity, etc. • Orientation towards team work: level of satisfaction with the learning • Feedback orientation: satisfaction with instructor monitoring, feedback and feedback quality • Overall satisfaction with the simulation experience: overall satisfaction with the general quality of the training activity • Relevance of trainee preparation for simulation: • Scenario characteristics: suitable number of trainees per scenario, staff distribution, scenario fidelity and complexity. Time available for the simulation experience, feedback, methodologies, etc... • Environmental conditions during the simulation experience: noise, physical conditions, time estimated by the trainees for the learning tasks, time available for the simulation experience • Competency development of the instructors: trainee perception of a) level of experience of the instructor in the clinical activity being trained, b) level of orientation, training and prior experience of the instructor in simulation • Trainee selection: instructor perception of correspondence of trainee profile with activity design

3.3.3 Learning

On this level we attempt to measure the degree to which the participants improve their knowledge and skills and undergo changes in attitudes as a result of the training experience.

Our approach follows the theoretical training evaluation model of Kirkpatrick and the educational principles presupposed by it, while, in addition, contemplating the variety of tools applied to the simulation experiences themselves, bearing in mind the complexity of these experiences and of the clinical context itself. On this level we propose to evaluate the variables relating to the degree of improvement and the evolutionary progress of the three learning domains, psychomotor (skills), affective (attitudes) and cognitive (knowledge).

Within the framework of simulation experiences, many tools are available for evaluating the benefits in trainee competencies of the training activity. The most typical of these are test performed before and after the simulation experience. However, another series of indicators has been identified, through documented evidence and the piloting experience developed by the SIMBASE project, that may be complementary to these tools and provide a deeper understanding of the results obtained. For example, direct observation, where the observer follows guidelines or a list of possible behaviours, may be used to identify behaviours that demonstrate that the trainees have mastered the content. This observation would be more useful if the performances were recorded, for example on video, for subsequent sharing with the students. This may prove to be a very powerful tool, especially if the results are reviewed with the instructor in order to identify the learning results and the possible cognitive or practical gaps.

In a complex simulation situation in which a variety of integrated results may be obtained, a listing of each of the learning results with their corresponding behavioural patterns may be required in order to measure the integration of all the competency types under evaluation. Some studies, such as Herm et al (2007), Lasater (2007) or Todd et al (2008), attempt to measure the three types of competency simultaneously.

Bearing in mind the general nature of our proposal, we recommend these types of tools for application in function of the objectives of the training activity. It is also possible to employ two evaluation approaches, one with general indicators per trainee on an activity or programme level, and the other, which relates and measures the improvements in each competency trained. The types of competency, in addition, will depend on the healthcare profession in question.

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>3.1</td><td>Learning evaluation</td><td>Learning</td><td>• Degree of learning experienced by the participants in the simulation experience</td><td>During the simulation experience
Shortly after the simulation experience and prior to the feedback phase.</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate trainee learning in the three principle domains (skills, attitudes and knowledge)</td></tr>
<tr><td colspan="2">Evaluation techniques: Self-reporting, direct observation, initial and final tests, attitude scales, video recordings</td><td colspan="3">Evaluation tools:
• Cognitive domain (knowledge): initial and final tests, practical exercises in situ
• Psychomotor domain (skills): observation outline, video recording, list of behaviours, simulator reports, practical exercises in situ
• Affective domain (attitudes): Likert-type questionnaires, self-feedback, observation</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Instructors</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">Evaluation of learning results in relation to simulation experience:
• Percentage skills increase
• Percentage knowledge increase
• Percentage attitudes increase
• Average progress obtained
• Self-confidence
• Clinical judgement/decision-making: demonstrates astute clinical judgement and development of critical thinking
• Communication/collaboration with team. Team interaction.
• Perception of professional conduct: preparation for simulation beyond the course expectations, recognition of ethical aspects of healthcare, demonstration of respect for customers and team members, search for guidance or suitable validation.</td></tr>
</table>

3.3.4 Transference (performance)

Transfer to practise during simulation activities is one of the final objectives of results evaluation – the extent to which acquired skills are generalised and applied to real clinical situations. Authors such as Kuduvalli (2009), Fraser et al (2011) and Sturm et al (2008), have demonstrated through case studies that simulation, in comparison to traditional teaching methods, increases both the degree of retention of what has been learned and the transfer of acquired skills to real clinical environments.

This evaluation level contains two important dimensions - application of acquired competencies to clinical practise (conduct or behaviour) and the performance resulting from this behaviour.

Transfer may be conscious (intentional, or "high road" transfer), or automatic. Automatic transfer is enriched with the local learning contexts and includes the physical surroundings, suitable performance of the roles of the different actors and evaluation of the expectations of the students. Analysis of the environmental and contextual factors that affect transfer, either positively or negatively, is one of the most relevant aspects to be taken into consideration, and one which we are committed to in our approach. Bearing this in mind, the inclusion of questionnaires from models such as Holten et al. (1996, 2007), or those esteemed by Tejada (2007) is a useful way of evaluating the factors that influence the transfer of clinical learning.

It is important to analyse the influence, either as obstacles or as facilitators, of the critical success factors for success of transfer in simulation. For this reason we encourage evaluation of the incidence of critical factors for general training evaluation common to the proposals of both Holton and Tejada, such as aspects relating to motivation and individual and organisational capacity for transfer, as well as other aspects particular to simulation-based training, such as orientation towards deliberate practise, instructor competency, simulator and scenario fidelity, curricular integration of simulation, etc.

It is possible to evaluate this level using a combination of methods, such as, on the one hand, direct observation, gathering information relating to patient activity and safety and questionnaires and, on the other hand, indirect methods, such as evaluation by superiors and co-workers using questionnaires.

The participation of different actors is required for this evaluation method, including the superiors, who evaluate trainee performance, and co-workers, who interact with the trainees during clinical practise.

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>4.1</td><td>Transference (Performance)</td><td>Performance and Behaviour evaluation</td><td>Trainee perception of performance and behaviour in clinical practise</td><td>0 to 6 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate trainee perception of competencies and their performance.</td></tr>
<tr><td colspan="3">Evaluation techniques: surveys, observation, semi-structured interviews.</td><td colspan="2">Evaluation tools:
• Questionnaire with open questions relating to trainee performance evaluation in clinical practise (self-evaluation)
• Questionnaire with open questions, interviews with superiors and co-workers
• Observation guidelines relating application of competencies to clinical situations</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees (Clinical managers or, in universities, teachers and professors)
• Co-workers</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">For trainees:
• Professional performance: Transfer to clinical practise after a short interval, level of application of each of the trained competencies, teamwork, commitment, orientation towards quality, type of scenario where the acquired competencies are applied, degree to which the simulation experience has contributed to, or is related to, changes and improvements in the workplace, usefulness of the knowledge and skills acquired, etc..
• Training requirements: Gaps to be remedied in knowledge and skills detected through practical application
For superiors and co-workers:
• Application of acquired competencies: opportunities for application, level of application prior to the simulation experience, level of application after the simulation experience, reasons for lack of application
• Contribution to transference: expectations regarding training, monitoring of trained personnel, commitment to support, acceptance/resistance by group/superior of the changes inherent by the new behavioural paradigm, adaptation to the new behavioural paradigm in the incentives and group regulation models
• Training requirements: Gaps in knowledge and skills, detected through practical application, that are to be remedied</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>4.2</td><td>Transference (Performance)</td><td>Competency retention</td><td>Perception regarding retention of application of acquired competencies in clinical practise</td><td>9 to 20 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate perception of retention of application of acquired competencies to clinical practise</td></tr>
<tr><td colspan="3">Evaluation techniques: surveys, observation.</td><td colspan="2">Evaluation tools:
• Open questionnaire relating to evaluation of practical clinical performance
• Observation protocol regarding practical clinical application of competencies.</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Supervisor (clinical manager, student tutor)
• Co-workers.</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Real clinical practise scenarios where trainees continue application of acquired competencies
• Degree of retention of simulation-based training experience
• Perception of the need for further simulation-based training
• Type of competency still applied
• Degree of application of these competencies (before-after)</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>4.3</td><td>Transference (Performance)</td><td>Motivation for transfer</td><td>Evaluation of aspects relating to motivation which influence transfer of acquired competencies to the workplace</td><td>0 to 6 months following conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate trainee motivation for transfer of acquired competencies to clinical practise</td></tr>
<tr><td colspan="3">Evaluation techniques: surveys</td><td colspan="2">Evaluation tools:
• Questionnaires relating to factors that influence transfer.</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Performance expectations for efforts made in transfer: expectations about whether or not efforts made in learning will lead to changes in performance in the workplace
• Expectations regarding results of transfer: expectations about whether or not changes in workplace performance will lead to positively evaluated results
• Motivation for transfer: orientation, intensity and persistence of the efforts dedicated to application of skills and knowledge learned in the workplace
• Self-efficacy: trainee perception about their own ability to change their behaviour at will</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>4.4</td><td>Transference (Performance)</td><td>Organisational context</td><td>Evaluation of aspects relating to the influence of organisational context on transfer of acquired competencies to the workplace.</td><td>0 to 6 months following conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• To determine whether or not the organisational context influences the transfer of acquired competencies to the workplace</td></tr>
<tr><td colspan="3">Evaluation techniques: Surveys, semi-structured interviews.</td><td colspan="2">Evaluation tools:
• Questionnaires relating to influential factors in transfer
• Semi-structured interviews.</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Superiors
• Trainees.
• Co-workers.</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Adherence to organisational objectives: the perceived alignment of the training with the strategic management and objectives of the organisation. Knowledge of the strategic management of the organisation about the training activity. Commitment of the strategic management of the organisation. Existence of hospital registers regarding participants in simulation activities. Consideration of simulation as accreditation criteria for healthcare professionals.
• Curricular integration of simulation: degree of alignment of the organisation's educational plans and strategies with simulation-based training
• Orientation towards evaluation of results: degree to which the organisation's policies are oriented towards obtaining results
• Workplace environment: organisation, support by co-workers, training performance, positive individual results (degree to which training application to the workplace leads to positive results for the individual), negative personal results (degree to which trainees believe that failure to apply the skills and knowledge acquires in training to the workplace will have a negative personal results), communication barriers that inhibit changes in behaviour, lack of feedback.</td></tr>
</table>

ID	Process	Dimension	Description	When to perform the evaluation.
4.5	**Transference (Performance)**	Individual capacity for transfer	Aspects relating to the influence of individual capacity on transfer of acquired competencies to the workplace	0 to 6 months following conclusion of the simulation experience
Objective		• Evaluate the aspects relating to the influence of individual capacity on transfer of acquired competencies to the workplace		
Evaluation techniques: Surveys.			**Evaluation tools:** • Questionnaires relating to factors influential to transfer	
Profiles included in the evaluation		• Superiors		
Dimensions and Indicators		• Individual capacity for transfer: degree to which individuals have the time, energy and disposition to make the necessary changes to transfer learning to the workplace • Perception of content validity: trainee perception of the degree to which the training content provides a response to the workplace requirements • Training design oriented towards transfer: degree to which training has been designed and provided to enable the trainee to transfer the learning to the workplace, and to which the instruction received during training coincides with the workplace requirements • Opportunities for application of the acquired competencies: degree to which the trainees may obtain, or already possess, resources and tasks that allow them to apply the competencies acquired to the workplace.		

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>4.6</td><td>Transference (Performance)</td><td>Simulation experience critical factors</td><td>Aspects relating to the influence of simulation experience factors on the transfer of acquired competencies to the workplace</td><td>0 to 6 months following conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the aspects relating to the influence of factors inherent to simulation on transfer of acquired competencies to the workplace</td></tr>
<tr><td colspan="3">Evaluation techniques: Surveys.</td><td colspan="2">Evaluation tools:
• Questionnaires relating to factors influential to transfer
• Check List of Main Dimensions in the Simulation Application</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Instructors</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Deliberate practise: possibility of repeating techniques during the session, levels of difficulty, degree of concentration, perception of the level of commitment to the activity, etc.
• Feedback
• Simulation methodology: suitable methodology depending on the simulation and clinical practise objectives
• Focus on teamwork: use of teamwork during feedback
• Scenario characteristics: suitable number of trainees per scenario, staff distribution, scenario and simulator fidelity, complexity, time available for the simulation experience, feedback, methodologies, etc.
• Environmental conditions during the simulation experience: noise, physical conditions, time estimated by trainees for the learning, time available for the simulation experience</td></tr>
</table>

3.3.5 Impact

Impact evaluation, from a training impact perspective, consists of making a comparison between the initial situation and the situation after training has been provided. The purpose of this comparison is to reveal changes that may be attributed to the training under evaluation.

Another series of factors, both individual and inherent to the social context in which the training takes place, intervene in the identification of changes which are attributable to training. These factors may create much uncertainty regarding the degree of contribution of the training itself.

Identification of the influence of these

'other' factors is a requirement for realistic evaluation models that attempt to gauge, with the greatest level of assurance possible, the degree to which this impact is attributable to the training activity, and whether or not it would have occurred if the training had not taken place.

Evaluation of training impact requires consideration of different areas, or levels of evaluation. The International Labour Organisation, in its guide proposal, takes into account three basic areas of impact, namely, personal, entrepreneurial and social (Aderito,2005). In other words, it takes into account the repercussions of training in 1) the individual performance of the person who has received the training, 2) the organisational performance as a result of the contribution of the person who has received the training and 3) the sectors in a country, or region, that benefit from the contributions of the organisational actions. These are equivalent to what in the general evaluation field are generally known as micro, meso and macro levels.

In impact evaluation of simulation-based training on an individual level, self-efficacy, self-confidence, clinical judgement and retention of competencies over time are all taken into consideration. To our knowledge, there are no available studies that approach the evaluation of the impact of simulation experiences on wider ranging areas such as organisational or sectorial contexts. In the USA, methodologies exist (Pages, 2000) which approach evaluation of the impact of simulation from a financial perspective by applying studies of Return on Investment (ROI) relative to patient safety (costs of avoided errors). For this reason we feel it would be interesting to include a Return on Investment in Simulation evaluation study in the subsequent phase, as a complementary element to impact evaluation for simulation-based training experiences.

Based on all the considerations and foundations of this proposal, and bearing in mind the educational and epistemological principles of our approach, we propose evaluation of three areas of impact:

Individual: analysis of self-efficacy, self-confidence, critical thinking/ decision making, clinical judgement and improvement in the socio-professional performance of the trainee.

Organisational: improvement in service and the quality of patient care and safety, health indicators, human resource indicators, improvements in organisational capacity for research as well as clinical activity costs and variance.

Healthcare community: improvements in community hospital services, patient care quality, health and human resource indicators.

Logically, the repercussions for the healthcare sector, or community, are pertinent to important training programmes that are part of large scale healthcare and education network strategies. We do not believe, however, that they are pertinent to the evaluation of individual training activities.

The time factor is fundamental to this type of evaluation. Impact evaluation implies that some time has passed in order for the effects to appear, and this time factor must be appropriate to the type of evaluation area. In the case of simulation, changes in trainees tend to occur over a shorter period of time and evaluation of retention is viable from six months after the transfer has been evaluated. In order to facilitate the application of a series of evaluation tools, we recommend applying them over not-to-distant time periods to optimise the resources.

Capturing the indirect information relating to the impacts generated by training is a complex issue. This proposal emphasises the need for applying a variety of types of tools, both direct, indirect, and in combination, in the same way as with transfer evaluation, applying triangulation to the analysis of the relevant information. Basically, we recommend the use of questionnaires relating to the trainees, the superiors, co-workers, and managers, complementing them with observation guidelines, particularly for the evaluation of impact on efficiency/self-efficacy, and a final, interview-based approach which will provide qualitative elements that will enable us to identify events or actions that generate results and to establish causality relationships.

With regard to changes in the trainees and in the organisation, it is relevant to include a random sample of patients who have received treatment from trainees who have practised the technique in the simulation training programme. For this reason we recommend the gathering of patient histories and analysis of the information contained in the healthcare information system in the centres as complementary elements to the evaluation.

These tools should take into consideration the analysis of information compiled on the indicators under evaluation from the initial evaluation phase, performing a before-and-after comparison, particularly in the case of changes in trainee performance and in the health indicators under evaluation, for example the degree of reduction in the number of complications in surgical operations, or the degree of reduction in patient waiting times. A suitable combination of complementary evaluation methods for simulation-based training provides a more complete perspective of the complex reality of clinical practise, and attempts should be made to capture this complexity by the design of suitable measuring tools and suitable methods of subsequent analysis. Furthermore, when investigating impact evaluation, the use of complementary evaluation techniques is useful in these cases for analysing the internal and external validity of the investigation through analysis of the possible factors which have influenced, or may be exercising influence at the time of evaluation.

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.1</td><td>Impact Evaluation</td><td>Individual level: Trainee Self-confidence</td><td>Impact of the trainee simulation experience in clinical practise</td><td>At least 6 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation-based training experience in the self-confidence of the trainee in clinical practise.</td></tr>
<tr><td colspan="3">Evaluation techniques: Surveys.</td><td colspan="2">Evaluation tools:
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the participants
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the superiors and co-workers</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Superiors
• Co-workers</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Degree of self-confidence attained: increased self-control, reduced self-control and confidence, increased self-confidence, etc.</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.2</td><td>Impact Evaluation</td><td>Individual level: Efficiency/Self-efficacy</td><td>Impact of the simulation experience of the self-efficacy of the trainee in clinical practise.</td><td>6 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation experience of the self-efficacy of the trainee in clinical practise.</td></tr>
<tr><td colspan="3">Evaluation techniques: Surveys, direct observation.</td><td colspan="2">Evaluation tools:
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the participants
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the superiors and co-workers</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Superiors
• Co-workers</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Increased ability to deal with complications relating to the technique in clinical practise
• Degree of technical mastery attained (before-after)
• Degree of improvement in the use of available resources
• Frequency of use of the technique: Increase in the number of times the technique is used (before-after), weekly percentage increase, variation in the number of patients who have had to undergo repetition of the technique
• Reduction in the number of errors</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.3</td><td>Impact Evaluation</td><td>Individual level: Critical thinking/Clinical decision making</td><td>Impact of the simulation experience on trainee capacity for clinical judgement/clinical decision making in clinical practise</td><td>6 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation experience on the trainee's capacity for clinical judgement/clinical decision making in clinical practise</td></tr>
<tr><td colspan="3">Evaluation techniques: Surveys.</td><td colspan="2">Evaluation tools:
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the participants
• Questionnaire regarding the impact of the simulation experience on the performance improvement of the superiors and co-workers</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Superiors
• Co-workers</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Clinical judgement: degree of demonstration, over time, of astute clinical judgement, making appropriate, responsible decisions, degree to which this is demonstrated
• Critical thinking: Degree of demonstration, over time, of well-developed critical thinking
• Degree of demonstration, over time, of a correlation between theory and process during patient care</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.4</td><td>Impact Evaluation</td><td>Individual level: Improvement in the quality of socio-professional performance of the participant</td><td>Impact of the simulation experience on the quality of the socio-professional performance of the participant</td><td>6 months after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation experience on the quality of the socio-professional performance of the participant.</td></tr>
<tr><td colspan="3">Evaluation techniques: Wide-ranging surveys, semi-structured interviews.</td><td colspan="2">Evaluation tools:
• Questionnaire regarding the impact of the simulation experience on improvements in the participants' performance.
• Semi-structured interviews.</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Trainees
• Supervisors
• Co-workers.</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Employment opportunities: perception of improvement in employment opportunities, change of employment as a result of the training received, incursion into other work-related areas, such as clinical research
• Work relations: perception of the degree of influence of the simulation-based training received on the improvement in relations within the workplace
• Patient care: (before-after), evaluation of the improvements in patient care, perception of the degree of influence of the simulation experience in the patients, perception of patient satisfaction, of communications with the patients, of patient safety</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.5</td><td>Impact Evaluation</td><td>Organisational level: Impact and long-term effect in the organisation.</td><td>Impact of the simulation experience in the results in the organisation.</td><td>From 9 months to 2 years after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation experience in the results in the organisation.</td></tr>
<tr><td colspan="3">Evaluation techniques:
Semi-structured interviews, documentary examination.</td><td colspan="2">Evaluation tools:
• Wide-ranging interviews with participants regarding improvements in results indicators in the organisation
• Wide-ranging interviews with superiors and co-workers regarding improvements in results indicators in the organisation
• Consultation of hospital records and documents.
• Information systems in the centre
• Estos instrumentos se aplicarán antes y después de la actividad o el programa formativo</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Supervisors
• Managers
• Trainees.
• Patients</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Improvements in the service provided: perception of the degree of influence on improvements in the services provided by the hospital, healthcare centre, or centre where the work is carried out, as a result of the simulation experience, register of the changes provided by simulation on an individual and organisational level.
• Improvements in the quality of patient care and safety: evaluation of the improvements in patient care, perception of the degree of influence of the simulation experience on the patients, reduction of patient waiting times, improvements in patient safety as a result of the simulation experience results.
• Health quality indicators: Increase in the number of surgical operations, reduction in patient waiting times, reduction in errors, reduction in clinical variance
• Human resource indicators: increase in the number of doctors trained/accredited for operations trained in the simulation experience, increased retention of competencies due to increased training
• Improvements in organisational capacity for research: new research relating to the application of simulation techniques performed by participants in simulation-based training experiences, number of participants trained in simulation-based training programmes who are involved in related research, etc.</td></tr>
</table>

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.6</td><td>Impact Evaluation</td><td>Regional level: Impact/long-term effect on the healthcare community</td><td>Impact of the simulation experience on the healthcare community</td><td>1 to 4 years after conclusion of the simulation experience.</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the impact of the simulation experience on the healthcare community</td></tr>
<tr><td colspan="3">Evaluation techniques: Wide-ranging surveys, semi-structured interviews.</td><td colspan="2">Evaluation tools:
• Wide-ranging interviews with superiors and managers regarding improvements in results indicators in the organisation
• Consultation of hospital records and documents.
• Information systems in the centre
• These tools should be applied before and after the training event or programme</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">• Supervisors
• Managers.
• Human resources administrators</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Improvements in the service provided: perception of the degree of influence in improvements in the services provided by the hospital as a result of the simulation experience, register of the changes provided by simulation on an individual and organisational level.
• Improvements in the quality of patient care: evaluation of the improvements in patient care, perception of the degree of influence of the simulation experience on the patients, reduction of patient waiting times.
• Health quality indicators: Increase in the number of surgical operations, reduction in patient waiting times, reduction in errors
• Human resource indicators: increase in the number of doctors trained/accredited for operations trained in the simulation experience, number of participants in knowledge networks relating to simulation, number of initiatives presented in regional policies relating to simulation-based education, number of articles published relating to simulation experiences.</td></tr>
</table>

3.3.6 The profit aspect of simulation:

Impact evaluation contains an aspect which is commonly known as the 'financial impact' of training, or 'training profitability' (Kirkpatrick, 1999, Philips, 1997, Pineda, 2002). In the current crisis scenarios the evaluation of the impact of training plays a very important role and, indeed, becomes essential if one is to make sense of investments in employee training. According to Pineda (2002), evaluation should precede investment as a means of gathering information regarding the expected results.

Training profitability is generally evaluated using a variety of methods and types of analysis, one of the more common of which is the cost-benefit analysis, or analysis of return on investment (ROI). In the healthcare field, ROI is generally measured by the traditional analysis of costs, benefits and the profitability that supposes the relationship between these two. While calculation of costs in hospitals is generally thought to be relatively simple, many benefits from clinical applications relating to the provision of quality and safety are not easy to translate into monetary terms (Pages, 2000).

According to Page (2010), the clinical ROI should be measured in terms of impact on the care and safety of the patient. Along these lines, the Center for Learning and Innovation in the U.S. (Patel, 2012) has developed he developed a methodology which operationalizes the impact of simulation-based training in terms of the profitability inherent in a reduction in the number of errors relating to patient safety and the savings this supposes for the healthcare centre. The relationship between simulation and patient safety has been proven to be a basically direct relationship, and students who practise techniques in simulated environments show increases in self-confidence, self-efficacy and the quality of patient care.

The profitability of simulation-based training, therefore, may be evaluated in terms of improvements in patient safety which, in turn, would translate into impact indicators associated with the savings implied for the healthcare centre by the reduction in medical errors that may affect patient safety, established by the following formula:

"(Nº errors encountered x estimated cost per error) – simulation costs) x % saving per error"

Simulation costs

In order to carry out this methodological procedure, the initial planning phase should take into account all the costs relating to investment in simulation as well as the impact indicators which would be evaluated once the benefits of the simulation-based training programmes had been translated into financial terms.

Analysis of simulation costs, however, implies control over information relating to simulation design as well as the

associated indirect costs. These may be revealed by analysing the financial reports of the healthcare or education centre and by examination of information relating to the number of hours spent using simulation, the simulators, the number of sessions, etc.

In order to evaluate the benefits it is essential to monitor the indicators to be evaluated once the training has concluded. To achieve this, we recommend examination of information relevant to the healthcare information systems, which may be made viable by developing specific monitoring tables.

It is important, however, not to adopt a reductionist attitude to evaluation, and for this reason we propose that, where possible, the financial impact evaluation be complemented using interviews with the healthcare centre managers for analysis and identification of factors that may exert influence on the evaluation, basing the information on all the previous processes proposed in this model. In addition, calculation of the benefits and translation of these to the indicators to be measured requires an in-depth analysis from a variety of perspectives and should include the different agents involved in the organisation. This is the perspective of this proposal, a holistic model for evaluation of simulation management oriented towards impact.

ID	Process	Dimension	Description	When to perform the evaluation.
5.7	**Evaluation of return on investment.**	Simulation benefits	Selection of the most pertinent results areas for the programme or activity under evaluation to which ROI may be applied	

Objective	• Identification of the most pertinent results areas for the programme, or activity under evaluation, to which ROI may be applied
Evaluation techniques: Surveys, interviews, examination of information systems and documentation	**Evaluation tools:** • Wide-ranging interviews with superiors and co-workers regarding improvements in results indicators in the organisation • Wide-ranging interviews with participants regarding improvements in results indicators in the organisation • Consultation of hospital records and documents. • Information systems in the centre
Profiles included in the evaluation	• Supervisors • Managers. • Patients
Dimensions and Indicators	• Improvements in the service provided: perception of the degree of influence in improvements in the services provided by the hospital as a result of the simulation experience, register of the changes provided by simulation on an individual and organisational level. • Improvements in the quality of patient care: evaluation of the improvements in patient care, perception of the degree of influence of the simulation experience on the patients, reduction of patient waiting times. • Health quality indicators: Increase in the number of surgical operations, reduction in patient waiting times, reduction in errors, reduction in clinical variance • Human resource indicators: increase in the number of doctors trained/accredited for operations trained in the simulation experience.

<table>
<tr><th>ID</th><th>Process</th><th>Dimension</th><th>Description</th><th>When to perform the evaluation.</th></tr>
<tr><td>5.8</td><td>Evaluation of return on investment.</td><td>Return on investment</td><td>Analysis of the profitability of the investment in the simulation programme, or activity</td><td>From 9 months to 2 years after conclusion of the simulation experience</td></tr>
<tr><td colspan="2">Objective</td><td colspan="3">• Evaluate the profitability of the investment in the simulation programme, or activity</td></tr>
<tr><td colspan="3">Evaluation techniques:
Analysis of return on investment</td><td colspan="2">Evaluation tools:
• Application of the selected return on investment analysis formulas</td></tr>
<tr><td colspan="2">Profiles included in the evaluation</td><td colspan="3">(Only evaluators intervene here)</td></tr>
<tr><td colspan="2">Dimensions and Indicators</td><td colspan="3">• Number of errors found before the program.
• Estimated cost for errors.
• Number of errors identified after training programs.
• The number of errors decreased product simulation program
• Savings per error
• % Savings per error
• Cost of the simulation.

(Nº errors encountered X estimated cost per error) – simulation costs) * % saving per error
simulation costs</td></tr>
</table>

4 APPLICATION OF THE MODEL: EVALUATION MANAGEMENT.

4.1 Recommendations for evaluation implementation.

How to incorporate evaluation of simulation-based training programmes into organisational practise?

First of all, evaluation of impact-oriented management should be considered as an investment by healthcare and education centres, rather than a cost. As Pineda () recommends, evaluation should precede investment as a means of gathering information regarding the expected results.

For this reason, when preparing a budget for an activity, programme, or plan, the costs required for evaluation should be included, as these become an important source of information regarding medium- and long-term savings and should be directly proportional to the overall training budget.

The SIMBASE project proposal takes into account:

- Consideration of simulation-based training as one of the practises that should be incorporated into the organisational tasks and routine processes, rather than as an isolated practise. Its management and impact, furthermore, should be evaluated.
- Consideration of the evaluation of simulation-based training from the perspective of evaluation of the impact and long-term effects on the clinical performance of the trainees and the organisation as well as its financial profitability.
- Consideration of the impact of simulation-based training as a holistic system that includes:
- The clinical factors that favour the success of simulation implementation (identification of requirements, organisational context, curricular integration, teamwork, training activity design, deliberate practise, constant orientation towards feedback, etc.)
- Evaluation of the different learning levels: (satisfaction, learning, transference (performance), impact (long-term effects) and profitability of simulation-based training).

If suitable orientation towards requirements does not exist, beginning with the obvious relevance of the training activity, and if it is not possible to verify whether or not simulation has contributed to improvements in knowledge, skills and attitudes of the trainees and their application to clinical practise, implementation of simulation as part of the

training strategy of the organisation will not generate the expected long-term changes in the individuals, the healthcare organisations, or the healthcare community.

What is required for a correct evaluation of simulation-based training?

Whether we are concerned with a simulation-based training programme or isolated training activities, evaluation should be included in the plans from the design phase and the following requisites should be taken into consideration:

- Evaluation design: focus on measurement.
- Formation of the evaluation team.
- Technical and financial resources.
- Methodology for information gathering and analysis.
- Evaluation schedule.
- Evaluation agents.

1. Simulation evaluation design: focus on measurement.

Up until now, evaluation of simulation as an educational methodology has been performed as an isolated process using simple evaluation tools. The design proposed here emphasises the need to consider evaluation from the initial planning stage of the training activity, bearing in mind the quality and influence of activity planning and the critical factors associated with simulation in the learning process, as we have stated throughout this document.

Evaluation design should have clear and concise objectives and its scope should be in accordance with these objectives. Evaluators and training programme/activity managers should design the evaluation in accordance with the evaluation levels that are considered pertinent and with a realistic scope that depends on the availability of time and resources and the scale of what is to be evaluated. Ideally it would take into account all levels, as the relationship is logical and procedural. Our proposal, however, includes dimensions, indicators and, subsequently, tools, for adaptation and use according to the evaluation objectives and the particular conditions of the simulation experience.

If the objectives of the evaluation of the particular simulation experience do not propose measurement of impact beyond that of the trainee, consideration and in-depth analysis of the evaluation of the skills and transversal competencies, and the impact of simulation on individual performance, self-sufficiency, self-confidence, the quality of direct patient care, communication, professional behaviour and clinical judgement of the trainees in clinical practise, would all be considered pertinent dimensions for evaluation of the principle long-term effects of simulation-based learning.

An effective evaluation of the training event design, in any case, should take into consideration the health indicators and competency requirements that constitute the basis for the simulation-based training requirements of the organisation, i.e. the indicators for which the training results should provide a response as a

measurement of the impact of this type of training on an organisational level. If these indicators are identified from the evaluation design stage, it will be possible to evaluate them on the basis of the learning results.

In order to facilitate decision making for training and healthcare centre managers, it is necessary to evaluate the changes and improvements experienced by the simulation participants in their clinical environment, in reference to the fact that learning results are not solely oriented towards "a destination", but take into consideration the processes and factors that may be influential, for example, the degree to which motivation, curricular integration, experience, or the workplace environment have a positive or negative impact on these learning results, or on the financial impact they may have on the organisation.

2. Formation of the evaluation team

If it is our intention to apply this model at its optimum level, ideally we should establish an integrated evaluation team that possesses a combination of technical competencies and is made up of the evaluators themselves as well as instructors, training activity managers and statisticians, or experts in research methodologies. Under less optimal circumstances, which is generally the case, sufficient resources are not available for the formation of a team with these dimensions. In this case it is essential, at the very least, to be able to count on the support of the organisation management in order to facilitate the incorporation, where necessary, of the aforementioned experts.

The resources required will depend on the scope of the evaluation. If return on investment is not an objective of the evaluation, for example, it will not be necessary to incorporate a financial expert. Or it may be possible, depending on the organisation's resources, to incorporate an expert from another department to perform this function when required.

For every team, optimal or not, it is necessary to reach an agreement on the terms of reference, the scope of the evaluation and the expected results. A work plan and a schedule will be agreed upon depending on the objectives of the evaluation.

In the SIMBASE experience, platform-based evaluation tools were developed and used by the committee members performing the piloting. On the basis of this experience, it is possible to systemise a far more accessible working formula, depending on the scope and scale of the evaluation, with very little resources.

Our proposal is to make these tools, along with instructions and utilities, available for use, thereby significantly reducing the need for resources, which may possibly be reduced to the extent that they consist solely of those responsible for developing the training plans, and the support of the administration.

3. Financial and technical resources.

The availability of the required simulation resources is essential for performance of the evaluation, and this to some degree depends on formation of an ideal evaluation

team which, in turn, depends on the support of the organisation's management.

For the design and evaluation of the evaluation tools themselves, it is essential to bear in mind the availability of sufficient resources. The basic tests may be applied, namely video recordings, to record the learning results and share them with the trainees, wide-ranging surveys, and support for the application of experimental or quasi-experimental methods for impact analysis. Along these lines, the use of ICT resources is essential for the application of information-gathering tools as well as for the availability of common interaction platforms, such as those used in the SIMBASE project, and which would be essential for application of the model, as we stated above.

Whether we are concerned with an isolated training event or a simulation-based training programme will obviously influence the quantity of resources required for the evaluation. The evaluation of entire programmes, then, may be an interesting strategy to employ, as it requires fewer resources over a longer period, which in itself is a method of making the investment in simulation more profitable.

In order to perform a subsequent profitability analysis, we should bear in mind that the resources required for evaluation, and their corresponding costs, should be taken into consideration during the investment analysis for the entire simulation-based training experience.

The proposal of this model is to create suitable strategies for sharing impact evaluation resources, and for reinforcing internal capabilities as a condition for the creation of a management and evaluation culture for impact-oriented simulation-based training experiences.

4. Methodology for information gathering and analysis:

Evaluation instruments.

Bearing in mind the complexity of clinical practise and, likewise, simulation as an educational methodology wherein a variety of competencies are trained in the same scenario, this approach proposes combining a variety of measuring tools, bearing in mind the viability of each of them alone, or in conjunction, depending on the learning domain to be evaluated (skills, knowledge, attitudes). The objective is to avail of straightforward measurements which will allow for comprehensive, valid measurement of the total impact that simulation experiences may have on individual learning and behaviour as well as on that of the organisations. For a realistic proposal, it is important to develop evaluation strategies that are coherent with the reality of each learning environment, and that always take into consideration a variety of variables that permit both an approximation to the complexity of the situation and the subsequent performance of triangulation during analysis.

Evaluation tools are designed in accordance with the scope of the study, the evaluation levels, and the variables to be measured. For this reason, we propose the use of both a self-evaluation approach as well as other

direct and indirect approaches. The most common method is the use of pre-tests and post-tests. However, the combination of these with other methods is more effective when all the results are finally triangulated, as we have said. Using direct observation, for example, we can measure the behaviour demonstrated by the trainees during the simulation experience as well as afterwards in practise in the clinical scenario. Indirect methods are applied through interviews and questionnaires with co-workers and superiors.

ICTs play a fundamental role in the application of tools for evaluation and information gathering, and provide the possibility of creating platforms for common administration of all evaluation tools and data organisation. In addition, their role in facilitating communication among participants in the evaluation experience and the evaluation team is essential for promotion of optimum use of resources and optimum quality of information gathering and analysis.

Finally, incorporation of both qualitative and quantitative evaluation strategies is recommended. A mixed approach provides the additional possibility of identifying priorities and difficulties based on the opinion and experiences of those involved. The qualitative strategies require the use of more flexible techniques focused on opinions, representations and behaviours that are difficult to access from a purely quantitative perspective. In our proposal, furthermore, a suitable combination of both methods is central for addressing the influence of a variety of factors in the results obtained.

Evaluation level	Evaluative process	Evaluation instruments
INITIAL EVALUATION	Professional profile	• Initial questionnaire for the participant • Initial questionnaire for the instructors
	Competency requirements	• Initial questionnaire for the participant • Initial questionnaire for the instructors
	Motivation and expectations	• Initial questionnaire for the participant • Initial questionnaire for the instructors
	Organisational context	• Initial questionnaire for Supervisors/ managers/ clinical unit managers/ university department directors • Initial questionnaire for the participants • Activity registers and results and health indicators for the organisation • Expert panels. • In-depth interviews with supervisors/ managers/ clinical unit managers/ university department directors
	Investment in the training activity	• Analysis of financial reports. • Simulator registries. • In-depth interviews with managers and those involved in financial administration • Questionnaires relating to course administrators/simulation design
EVALUATION OF SATISFACTION/ reaction	Participant and teacher satisfaction/ reaction.	• Satisfaction questionnaires for trainees • Satisfaction questionnaires for instructors • Check List of Main Dimensions in the Simulation Application

EVALUATION OF LEARNING	Learning: • Knowledge • Skills • Attitudes Self-efficacy Self-confidence Clinical judgement/ decision making Teamwork Critical thinking	• Cognitive domain (knowledge): - Initial and final tests - Practical exercises in situ - Self-evaluation. • Psychomotor domain (skills): - Observation outline/ check-off instrument - Video-recording - List of behaviours - Simulator reports - Practical exercises in situ • Affective domain (attitudes): - Likert-type test - Self-feedback
EVALUATION OF TRANSFERENCE	Performance and behaviour evaluation	• Open questionnaire for participants regarding their performance in clinical practise. • Observation guidelines regarding practical clinical application of competencies. • Open questionnaire for superiors and co-workers regarding transference and performance of the participants.
	Motivation for transference	• Trainee questionnaire regarding factors influential in the transfer of simulation-based learning.
	Organisational context	• Trainee questionnaire regarding factors influential in the transfer of simulation-based learning • In-depth interviews with supervisors/ managers/ clinical unit managers/ university department directors • In-depth interviews with trainees, or a representative sample • Open questionnaire for superiors and co-workers.
	Individual capacities for transfer	• Trainee questionnaire regarding factors influential in the transfer of simulation-based learning.

	Critical factors in simulation	• Trainee questionnaire regarding factors influential in the transfer of simulation-based learning • Instructor questionnaire regarding factors influential in the transfer of simulation-based learning
IMPACT EVALUATION	**Indidivual level: individual actions.** - Self-efficacy - Self-confidence - Critical thinking/ clinical decision making - Improvement in the quality of socio-professional activity of the participant	• Trainee questionnaire regarding the impact of the simulation experience on the improvement in their performance and their retention over time. • In-depth interviews with trainees/superiors/ managers/clinical unit managers, etc. • Open questionnaire for superiors and co-workers regarding the impact of the simulation experience on the improvement in the performance of the participants and their retention over time.
	Organizational level: Impact on the organisation	• In-depth trainee interviews. • In-depth interviews with trainees/superiors/ managers/clinical unit managers, etc. • Analysis of registers of quality and health results indicators in the organisation (before-after) • Interviews with a representative sample of patients treated after the training experience
	Regional level: Impact on the healthcare sector on a regional level.	• Wide-ranging interviews. • Analysis of registers of quality and health results indicators in the organisation (before-after) • Interviews with a representative sample of patients treated after the training experience.
RETORNO DE LA INVERSIÓN.	Organisational benefits	• Wide-ranging interviews with managers, etc. • Analysis of registers of quality and health results indicators in the organisation (before-after) • Interviews with a representative sample of patients treated after the training experience
	ROI	• Return of investment analysis of simulation-based programmes.

Table 6: Evaluation instruments by assessment level

5. Evaluation schedule

The correct occasion to perform evaluation is a key factor in the work plans of the evaluation team and schedules should be developed in accordance with the scope and objectives of the evaluation and the available resources. Each proposed evaluation level should be performed within specified time frames so that the effects on performance, transference to clinical practise and the long-term effects on the organisation can be appreciated. Evaluation should not be performed too early as the information may be contaminated by other variables, thereby exacerbating the habitual problems of attribution.

Application of these time frames depends on the corresponding level of evaluation, the type of training involved and whether or not we are dealing with evaluation of an isolated training event or simulation-based training programmes. Programmes are generally evaluated on conclusion of the programme, which can imply a time frame of three months, a year, or even longer.

This model establishes three key moments for evaluation, before, during and after, and clarification of the appropriate moment is relevant for the operational purposes of this proposal.

Before: For the purposes of our approach, this refers to the period prior to commencement of the simulation experience and refers principally to actions developed by the course administrator and the instructors, the preparation prior to design of the activity where the information required to ensure the quality of learning and the application of pre- and post-tests is evaluated. Information relating to impact indicators is usually identified during this phase, so correct performance is required to ensure evaluation of the improvement in the specified indicators.

During: This refers to the stage beginning with commencement of the activity and includes the primary trainee questionnaires up to the conclusion of the final debriefing session, taking into account evaluation of the learning during the simulation experience. Its quality is essential for analysis of the evaluation results in the stage subsequent to conclusion of the activity.

After: This refers to the stage that begins on termination of the debriefing session and includes application of satisfaction questionnaires and analysis of the effects and repercussions that occur in the different evaluation domains. For the purposes of our model, this stage has particular nuances and specific evaluation moments are established according to the particular evaluation level. For example, evaluation of satisfaction is performed shortly after conclusion of the activity, as is the evaluation of the learning level, bearing in mind that this refers to improvements or changes in the knowledge, skills and attitudes with respect to their levels before the course.

In other simulation studies evaluation of the changes and improvements in trainee performance is performed at the time of

evaluation, and satisfaction and learning are even evaluated using the same tools.

From our perspective, and based on the educational principles of our proposal, we consider it essential to evaluate the acquired competencies and the trainee performance in the simulation experience at various times: recently concluded the training activity and sometime afterward (about three months for evaluation of transfer and twelve months for impact evaluation) once the experience has been applied to the workplace and it is possible to analyse the associated retention and performance.

Before	During	After
• Initial questionnaire for supervisors, managers, clinical unit managers and university department directors • Activity registers and health and results indicators of the organisation • Panels of experts. • In-depth interviews with supervisors, managers, clinical unit managers and university department directors • Analysis of economic/ financial reports. • In-depth interviews with managers and those involved in financial administration. • Questionnaires associated with course administrators and simulation design. • Check List of Main Dimensions in the Simulation Application	• Initial trainee questionnaire • Initial instructor questionnaire • Video-recording • Practical exercises in situ. • Direct observation (control lists/ evaluation scales) • Simulator registries	• Trainee post-test questionnaire • Initial questionnaire for supervisors, managers, clinical unit managers and university department directors • Activity registers and health and results indicators of the organisation • Analysis of economic/financial reports. • Simulator registries. • In-depth interviews with managers and those involved in financial administration • Questionnaires associated with course administrators and simulation design. • Video-recordings • Practical exercises in situ. • Open trainee questionnaire regarding their performance in clinical practise • Observation outline regarding application of competencies to clinical practise • Open questionnaires for superiors and co-workers regarding performance and transference of the participants. • Trainee satisfaction questionnaires. • Instructor satisfaction questionnaires.

Before	During	After
		• Check List of Main Dimensions in the Simulation Application • Open questionnaire for participants regarding their performance in clinical practise. • Observation guidelines regarding practical clinical application of competencies. • Open questionnaire for superiors and co-workers regarding transference and performance of the participants. • In-depth interviews with supervisors/ managers/ clinical unit managers/ university department directors to transfer and impact evaluation. • Trainee questionnaire regarding the impact of the simulation experience on the improvement in their performance and their retention • Open questionnaire for superiors and co-workers regarding the impact of the simulation experience on the improvement in the performance of the participants and their retention over time. • Analysis of registers of quality and health results indicators in the organisation (before-after) • Interviews with a representative sample of patients treated after the training experience • Return of investment analysis of simulation-based programmes.

Table: Application of tools according to the moment of evaluation.

The agents involved

Tool design requires a strategy that includes a number of agents apart from the trainees and instructors. From our perspective, the role of the supervisors and organisation directors is central, as it allows for coherent integration of evaluation of simulation experiences in accordance with the organisational needs and strategies. This perspective on analysis is essential at all levels of the organisation, especially when we are concerned with evaluation of transfer and impact.

The inclusion of other agents, such as co-workers, is equally relevant, particularly in the case of transfer evaluation. The organisation should promote simulation as a strategy that involves everyone, and this should be reflected in the evaluation processes. The role of the patient, furthermore, should be considered vital, as they are the direct receptors of the benefits from improvement in the skills of the trainees. The inclusion of a representative sample of patients may be a key strategy in the evaluation of transfer and impact.

Design of evaluation tools depends on the relevant information that each of these agents may provide, and while this is usually common to training evaluation studies in general, it has particular relevance to simulation training experiences, bearing in mind that the relationship with clinical practise is potentially greater.

4.2 Subsequent actions, piloting and development of tools.

The objective of the current proposal is to establish a conceptual framework as a reference for the design of a model for evaluating the impact of simulation-based training experiences, particularly on the scale of training programmes. The development of evaluation tools, and their validation, has been identified as the next phase of the model, given their inherent complexity and the level of resources required. Based on all the above, we should proceed by analysing the following aspects:

- Development of evaluation tools in accordance with the dimensions, indicators and orientation established in the current model.
- Pilot and validate each of the tools and methods, attempting to identify the principle problems associated with validation and consistency.
- Promote the use of wide-ranging consultations which combine a variety of types of quantitative and qualitative evaluation tools and techniques as well as methods of traceability for identifying cause-effect relationships.
- Evaluate the use of quasi-experimental methods of evaluation in the impact phase.
- Update the technological platforms used in the SIMBASE project in accordance with new tool designs that appear.

REFERENCES

ACSA. (2013). Acreditación de Actividades y Programas de Actividades de Formación Continuada. http://mejorao.acsa.junta-andalucia.es/acsa_formacion/html/login.asp

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Theory. New Jersey: Prentice-Hall.

Bandura, A. (1997). Self-Efficacy: The Exercise of Control. New York: W.H. Freeman and Company

Bewley, B., O´Neil, H. (2011) Evaluation of medical simulations. CRESST/UCLA. Recuperado: 2012, 26 de Diciembre. Disponible en: http://www.cse.ucla.edu/products/overheads/TATRC/4_Bewley_William,_Oneil_Harry_-_Eval_of_Med_Sims_v3.pdf

Broussard, L. (2008). Simulation-based learning: how simulators help nurses improved clinical skills and preserve patient safety. Nursing for Women's Health, 12 (6). 521–524.

Biencinto, C. & Carballo, R. (2006). Determinación del impacto de la formación continua en el sector sanitario: diseño de un modelo de relaciones entre dimensiones. Revista complutense de educación, 17 (1): 77-88.

Bradley, P. (2006). The history of simulation in medical education and possible future directions. Med Educ 40 : 254-262

Chen, H. & Holton, E. F. & Bates, R. (2005). Development and validation of the learning transfer system inventory in Taiwan. Human Resource Development Quarterly, 16(1), 55–84.

Chief Medical Officer's (CMO). (2008). CMO annual report 2008. Safer Medical Practice: Machines, manikins, and polo mints. Recuperado el 12 de enero del 2013, Disponible en: http://www.bmsc.co.uk/pdf/DH-096227.pdf

Chlan, L. et al. (2008). Influence of an experiential education session on nursing students´s. Journal of Evidence-Based Complementary & Alternative Medicine, 10(3): 189-201.

Consejería de salud y Bienestar social de la Junta de Andalucía (CSJA). (2009). Plan estratégico de formación integral del Sistema Sanitario de Andalucía. Sevilla: Consejería de salud y Bienestar social de la Junta de Andalucía.

Devos, et al. (2007). The Learning Transfer System Inventory (LTSI) translated into French: internal structure and predictive validity. International Journal of Training and Development. 11:3.

DUBOIS, C-A., McKEE, M. & NOLTE, E. (2006). Human resources for health in Europe. Maidenhead: Open Universitiy Press. 19-20.

Ebbert, D.W. & Connors, H. (2004).

Standardized patient experiences: Evaluation of clinical performance and nurse practitioner student satisfaction. Nursing Education Perspectives, 25(1): 12-15.

Flin, R., Glavin, R., Maran, N. & Patey, R. (2003). Anaesthetists' Non-Technical Skills (ANTS) System Handbook, v1.0. Aberdeen: University of Aberdeen, Recuperado el 12 de Enero del 2013, Disponible en: http://www.abdn.ac.uk/iprc/documents/ants/ants_handbook_v1.0_electronic_access_version.pdf>

Herm et al, Scott, K., & Copley. (2007). Sim'sational revelations. Clinical Simulation in Nursing Education, 3(1): 25-e30.

Hravnak, M., Beach, M., & Tuite, P. (2007). Simulator technology as a tool for education in cardiac care. Journal of Cardiovascular Nursing, 22(1): 16-24.

Holton, E. F. (1996). The flawed four-level evaluation model. Human Resource Quarterly, 7(1): 5–25.

Holton, E. F., Bates R. A., & Ruona, W. (200). Development of a generalized learning transfer system inventory. Human Resource Development Quarterly, 11(4):333–60.

Issenberg, S., McGaghie, W., Petrusa, E., Gordon, D., & Scalese, R. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. Medical Teacher: 27, 10-28.

Jeffries, P. (2005). A framework for designing, implementing, and evaluation simulations used as a teaching strategies in nursing. Nursing education Perspectives, 26(2): 96-103.

Khasawneh, S., Bates, R., & Holton, E. (2006). Construct validation of an Arabic version of the Learning Transfer System Inventory for use in Jordan. International Journal of Training and Development, 10(3), 180–194.

Kirkpatrick, D. (1996), Revisiting Kirkpatrick's four-level model. Journal Training and Development, 50: p. 54-59.

Kirkpatrick, D. (2007). Implementing the four levels: A practical guide for effective evaluation of training programs. San Francisco: Berrett-Koehler Publishers, Inc.

Kolb, D. (1984). Experiential learning: experience as the source of learning and development. Englewood: prentice hall.

Lasater, K. (2007). Clinical Judment using simulation to create an assessment rubric. Journal of nursing education, 46(11): 496-503.

Lasater, K. (2007a). High fidelity simulation and the development of clinical judgment: Students' experiences. Journal of Nursing Education, 46(6): 269-276.

Leigh, G.T., 2008. High-fidelity patient simulation and nursing students' self-efficacy: a review of the literature. International Journal of Nursing Education Scholarship, 5 (1).

Littlewood, K. (2011) Higth fidelity simulation as a research tool. Best Practice & Research clinical Anaesthesiology, 25:

473-487

McGaghie et al. (2010). A critical review of simulation-based medical education research: 2003–2009. Medical Education, 44: 50–63.

McGaghie et al. (2011). Does Simulation-Based Medical Education With Deliberate Practice Yield Better Results Than Traditional Clinical Education? A Meta-Analytic Comparative Review of the Evidence. Academic Medicine, 86 (6)

Moore, D., Green, J., & Gallis, H. (2009). Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. J Contin Educ Health Prof: 29(1):1–15.

National Institute of Health Research. Department of Health. (2011). A framework for technology enhanced learning. UK: Published to DH website. Recuperado el 20 de Noviembre del 2012, Disponible en: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_131061.pdf

NHS Education for Scotland (NES) & Scottish Funding Council. (2007). Scottish Clinical Skills Strategy. Recuperado el 20 de Noviembre del 2012, Disponible en: http://www.csmen.scot.nhs.uk/media/18246/accessible_scottish_clinical_skills_strategy.doc

Nursing and Midwifery Council. (2007). Simulation and Practice Learning Project. Outcome of a Pilot Study to Test the Principles for Auditing Simulated Practice Learning Environments in the Pre-registration Nursing Programme. Recuperado el 13 de Noviembre del 2012, Disponible en: http://www.nmc-uk.org/aFrameDisplay.aspx?DocumentID=3703

Rhodes, M. L., & Curran, C. (2005). Use of the human patient simulator to teach clinical judgment skills in a baccalaureate nursing program. CIN: Computers, Informatics, Nursing, 23(5): 256-262.

Reilly, A. & Spratt, C. (2007). The perceptions of undergraduate student nurses of highfidelity simulation based learning: a case report from the University of Tazmania. Nurse Education Today, 27 (6): 542–550.

ORGANIZACIÓN MUNDIAL DE LA SALUD (OMS). (2006). Informe sobre la salud en el Mundo 2006-Colaboremos por la Salud. Ginebra. 25.

Patel, A. (2012). Using Data to Help improve a Return on Investment. Center for Innovative Learning. North Carolina: Laerdal.

Palés and Gomar. (2010). El uso de las simulaciones en educación médica. TESI, 11 (2): 147-169.

Phillips, J. (1997). Handbook of training evaluation and measurement methods. Oxford: Butterworth-Heinemann.

Pinzón, S. and Escudero, C. (2012). Modelo integral de Evaluación de la Formación del Programa Común de Especialistas en Formación. Escuela Andaluza de Salud Pública.

Prion, S. (2008). A practical framework for evaluating the impact of clinical simulation experiences in prelicensure nursing education. Clinical simulation in nursing, 4(3).

Quality Standard ISO/IEC 19796-1 for Learning, Education, and Training. (2005). Educational Technology & Society,10(2): 3-16.

SERRANO, R. & CERRILLO, JA. (2009). La formación en el Sistema Sanitario Público de Andalucía. Sevilla: Consejería de Salud y Bienestar Social. Junta de Andalucía. p. 220.

Sinclair, B. & Ferguson, K. (2009). Integrated simulated teaching/learning strategies in undergraduate nursing education. International Journal of Nursing Education Scholarship, 6 (1): Article 7.

Spector, N. (2006). Systematic review of nursing education outcomes: An evolving review. Chicago: NCSBN, Recuperado el 29 Septiembre del 2012, Disponible en: https://www.ncsbn.org/Final_Sys_Review_04_06.pdf

Stracke Ch. Quality Standards for Quality Development in e-Learning: Adoption, Implementation, and Adaptation of ISO/IEC 19796-1. (2007). Recuperado el 29 Septiembre del 2012, Disponible en: http://www.qed-info.de/downloads.

STUFFLEBEAM, D. (2002). Evaluación sistemática: guía teórica y práctica. Barcelona: Paidós.

Tejada, F., & Lafuente, E. (2012). El impacto de la formación continua: claves y problemáticas. Revista Iberoamericana de Educación, 58(3):1-14

The Carnegie Foundation. (2011). Educating Physicians: A Call for Reform of Medical School and Residency. Recuperado el 29 Septiembre del 2012, Disponible en: http://iamse.org/development/2011/was_090111.pdf

Todd, M., Manz, J., Hawkins, K., Parsons, M., & Hercinger, M. (2008). The development of a quantitative evaluation tool for simulation in nursing education. International Journal of Nursing Education Scholarship, 5(1): Article 41. Recuperado el 29 Septiembre del 2012, Disponible en: http://www.bepress.com/ijnes/vol5/iss1/art41

World of Health Organization (WHO). (2006). The World Health report: Working Together for health. Geneva. Switzerland: WHO Press.

Ziv, A., Wolpe, P., Small, S., & Glick, S. (2003). Simulation-based medical education- an ethical imperative. Academic Medicine, 78: 783-788.

Wade, P. (1994). Measuring the Impact of Training. Londres: Kogan Page.

Yaghi, A. (2008). Validation of the Learning Transfer System Inventory: A Study of Supervisors in the Public Sector in Jordan. HUMAN RESOURCE DEVELOPMENT QUARTERLY, 19 (3).

Address: Consejería de Salud y Bienestar Social.
Avda. De Hytasa, nº 14, Edificio Junta de Andalucía. Sevilla, 41071
Telephone: +34 955048207
Mobile Phone: +34 677906032
Email: info@simbase.co
Website: www.simbase.co