HEALTHY COMMUNITY EDUCATION & RESEARCH JOURNAL
HEALTH AND SAFER POPULATION

RESEARCH ARTICLE

Influence of Scenario-based Learning on problem-solving using critical thinking analysis approach in medical and health science education.

Huda Mohamed Ali Rasheed, MSN.

Ph.D. scholar's British University in Dubai, college of Educational Science, British University in Dubai, United Arab Emirates email: alhammadyh@yahoo.com.

Prof. Sufian A. Forawi
Professor of Educational science, college of Educational Science, British University in Dubai, United Arab Emirates email: sufian.forawi@buid.ac.ae

ABSTRACT

Introduction: With the abrupt changes in educational systems, the educational sectors and teachers tried to develop new skills and practice toward students' understanding of new skills and knowledge. So, there were some ways to encourage students to use their critical thinking and brainstorming to identify the problem or issues when providing scenarios based on clinical experience. **Objective:** the aim of this research study is to assess and explore the Influence of scenario-based learning on a critical thinking analysis approach in medical and health science education.. **Method:** This research study was a descriptive systematic review with meta-analyses for randomized control trials and quasi-experimental research studies that were conducted from the period of 2008 to 2022. The main themes of the research study were scenario-based learning on problem-solving by using a critical thinking approach abilities, the tutor's role in solving the struggles that students faced during the application of scenario-based learning, and the strategical plan of the medical and health professional education toward scenario-based learning. The subthemes from the theme of scenario-based learning on problem-solving by using a critical thinking approach ability were problem-solving techniques and the plan of action during patient care with the implementation of the plan of care provided during clinical practice. The meta-analyses were done for 15 research studies in the medical and health science education specialist. This research examined the analyses from these studies by using Revman Review Manager 5.4 software. **Result:** The result of the study showed that all the research participants were 5265 at 100% weightage and risk ratio, M-H, random, and 95% CI were 0.78(0.69, 0.89), with heterogeneity $Tau^2 = 0.05$, $chi^2 = 164.88$, and df= 14 (p=0.00001) that is highly significant($p < 0.05$). And the total effect was Z= 3.59 (p= 0.0003). **conclusion:** In conclusion, the study is supporting the research study with homogeneity results and is highly significant. Also, most of the research studies supported research studies that scenario-based learning is highly important in learning and teaching medical and health science specialties and this can help them before going to the training in the hospitals.

Keywords: scenario-based learning, critical thinking, problem-solving, medical & health science students.

CITATION: Rasheed, H., & Farawi, S. (2023) Influence of Scenario-based Learning on problem-solving using critical thinking analyses approach in medical and health science education. Healthy Community Education & Research Journal, Health & Safer Population, UAE. 1(1), 1-16. https://doie.org/10.1020/HCERJ.2023934947
CORRESPONDING AUTHOR: Correspondence concerning this article should be addressed to Huda Mohamed Ali Rasheed, College of Science Education, The British University in Dubai, Email: alhammadyh@yahoo.com
REVISED: 07/08/2023
ACCEPTED: 05/09/2023
PUBLISHED: 20/09/2023

Introduction:

Education is a very important element in building countries and communities. In the olden days, education was based on what was written in the books and students don't have the right to think in deep and analyze what they learned (Elliott-Kingston, Doyle, and Hunter, 2016). But, education nowadays is based on thinking and solving issues based on evidence and allowing students to build their own knowledge and information. Because of the abrupt changes in educational systems the educational sectors and teachers tried to develop new skills and practice toward students' understanding of new knowledge and skills (Bastable, 2019). So, there were some ways to encourage students to use their critical thinking and brainstorming to identify the problem or issues when providing scenarios based on clinical experience. Another way is by motivating their conceptual, reasonable, and achievements toward their thinking abilities when performing scenario-based learning skills (Bastable, 2019). These ways can help and encourage the students to build up base knowledge and can encourage their thinking skills and abilities toward solving any issues faced during clinical training. The medical and health sciences program empowers the students toward safe care practice, patient-focused methodology, intellectual professional skills, and practice approach by utilizing approaches of scenarios-based learning, problem-based learning, focus group discussion, team-based learning, and self-directed learning (Shin and Kim, 2013).

The scenario-based approach considers a new methodology in learning style, so many students struggle to understand and apply this new learning methodology. As scenario-based learning is defined as using interactive scenarios to support active learning strategies such as problem-based or case-based learning (Hursen and Fasli, 2017). It normally involves students working their way through a storyline, usually based around an ill-structured or complex problem, which they are required to solve. In the process, students must apply their subject knowledge, and critical thinking, and problem-solving skills in a safe, real-world context (Stewart 2002).

Moreover, the students transferring from school to university caused them to be in reality shocked by the new way of teaching and learning methodology cause them to be rigid and unadjustable to this new technique. This can be made learning and delivering knowledge more difficult for the teachers, causing them to find a solution that can help the student before going to the clinical areas and dealing with the patients (Bastable, 2019). So, this way applying scenario-based learning prepares the students to face reality when going to the hospitals for training. The researchers encourage to do more research studies on how the students interact with scenario-based learning and the use of critical thinking was effective when dealing with the problem faced during the scenario (Hursen and Fasli, 2017). So, the research aim was to assess and explore the Influence of scenario-based learning on a critical thinking analysis approach in medical and health science education.

Background:

Education, learning, and knowledge are essential parts of your life, the person without knowledge can face many problems in life, and struggles cause him to suffer from life. The countries made learning compulsory for all aged people so that everybody can learn and have knowledge. The educational sectors tried to improve and encourage students toward using their critical thinking and evidence-based to solve any issues faced during clinical training especially medical and health science students. These approaches that are done in higher education can provide safe care practice when taking care of the patient and reduce the risk of harm, danger, and injuries during clinical (Shin and Kim, 2013). Patient harm and injuries are one of the leading causes of morbidity and mortality rates worldwide, especially during care provided in hospitals. (Jamshidi, Hemmati Maslakpak and Parizad, 2021, Sayyah et al., 2017). The pupils of medical and health science specialty should gain high self-confidence, moral and ethical considerations, effective communication and collaboration skills, and finally wide range of knowledge and skills to perform any skills or solve any issues faced during clinical training and not cause any adverse effect or injuries to the patient while providing care (Jamshidi, Hemmati Maslakpak, and Parizad, 2021). Moreover, using critical thinking skills by assessing the issues faced by the patient, analyzing the problem by using concept mapping or mind mapping, and prioritizing the care delivered by identifying the most important issue that is to be solved first (Papathanasiou et al. 2014). All these procedures can be done when students use their critical thinking skills abilities and keep into

consideration the patient cultural deference and his rights (Papathanasiou et al. 2014). One of the best ways that many authors encouraged and stressed before providing care to the patients in the hospitals is the universities must make protocols to use scenarios that describe fully what the students can face before going to the clinical for training, this can reduce their stress and prevent reality shock (Hursen and Fasli, 2017). As Hussein Ahmed (2019) explained that using scenario-based learning improves students' skills, critical thinking capabilities, problem-solving paradigm, and collaboration with communication in team-focused skills. The concept of scenario-based learning captivating the environmental needs for training leads the learner to meet realistic work challenges and the feedback provided helps them to progress in a good, positive, realistic manner that helped them to grasp and understand the situation clearly and comprehensibly**.** (Explore the eLearning world with us, 2019).

Problem statement:

The scenario-based approach considers a new methodology in learning style, so many students struggle to understand and apply this new learning methodology (Bastable, 2019). Moreover, the students who transferred from school to university caused them to be in reality shocked by the new way of teaching and learning methodology cause them to be rigid and unadjustable to this new technique (Rahmani, Mohammadi & Moradi, 2016). This can be made learning and delivering knowledge more difficult for the teachers, causing them to find a solution that can help the student before going to the clinical areas and dealing with the patients. So, this way applying scenario-based learning prepares the students to face reality when going to the hospitals for training (Jamshidi, Hemmati Maslakpak, and Parizad, 2021).

Scenario-based learning on problem-solving by using a critical thinking approach:

This research study is tackling theme that were about scenario-based learning on problem-solving by using a critical thinking approach abilities, the tutor's role in solving the struggles that students faced during application of scenario-based learning, and the strategical plan of the medical and health professional education toward scenario-based learning.

The subthemes from the theme scenario-based learning on problem-solving by using a critical thinking approach abilities was problem-solving technique and the plan of action during patient care with the implementation of the plan of care provided during clinical practice. Scenario-based learning (SBL) the main theme means to use of interactive scenarios to support active learning strategies such as problem-based learning. It normally involves students working their way through strategic ways to solve the complex problems that are required to solve (Stewart 2002). The main theme strategy that used by educators and learners were about scenario learning. This strategies is type of advanced teaching style this will enhance the pupils educational knowledge, on the other hand, the old fashion teaching by using lecture strategies decrease the abilities of the students to be student-focus than teachers focus (Hussein Ahmed, 2019c)

In the process, students must apply their knowledge, critical thinking the second main theme, and problem-solving skills the subthemes to be in good and protective real world performance. to understand the scenario by using the pupils cognitive intellectual abilities to identify the problems explained in the scenario as real situation, this enhance students self-learning abilities, by clarifying the problems by doing assessments and later the students reflect on the scenario by explaining the problem and the planning of the solution needed. (Stewart 2002). Identifying the learning outcomes is important to identify what it is you want students to achieve on completion of the scenario, and then work backward from the learning outcomes to create the situation that will lead to this learning. Also, decide on the format that explains your scenario going to be delivered. This taking in to consideration utilizing the challenges and empowerment of the students when dealing with the patient in real world (Hussein Ahmed, 2019c). Furthermore, identify the trigger event or situation, this will be the starting point of your scenario. Creating the scenario to identifying decision points and key areas for feedback and student reflection. This is an effective way to focus on peer review by identifying the achievement goals that supposed to be achieved from the students when discussing about the scenario with the help of colleagues (Stewart 2002).

Problem-solving technique and the plan of action during patient care:

Medical and health sciences curriculum strategies focused on using intellectual thinking abilities to apply it in to real-life situation. This can be done by identifying the issues that must be prioritizing later on the management of risk faced during the application of implementation of the plan developed, this can be appeared when using cognitive thinking abilities in the situations. The process of solving the issues must be in order that first the problems that been explained must be identified and assessed, prioritizing the most important to be solved must be first and least important to be in the last, planning the care that to be given, made the plan to be implemented in the care, and evaluating the provided or implemented care. (Papathanasiou et al., 2014). The pupils can begin to debate and scan the data by using their contextual structure. The first step of identifying the issues using cognitive thinking is by doing assessment, this can be done when identifying the issues and refer it to the other literatures as reviewed and exploring the same phenomenon explained this can used as evidence from other researches to support the data been recognized (Nagshabandi, 2018). By using this approach the pupils can evaluate the data recognized and use it to help in real patient situation faced. (A Brunt, 2005). The important step that the students must understand and utilizes their cognitive intellectual abilities when planning for the care that were strategically approaches can be utilized by students to explore the patient issues faced and identify the most important issues to be tackled firstly, this can provide the care by systematically way. The prioritized plans that to be implemented to the patient care, the pupils can start with gathering information later on this information can help them to recognized the problem that to be solved, this can guide them toward implementation of the plan in systematic manner.

The tutor's role in solving the struggles that students faced during application of scenario-based learning:

When performing the care the last procedure that must be observed is called evaluation of the care given caused the patient to release his struggles and solve his problems (YILDIRIM, ZKAHRAMAN 2011). The care plan as the subthemes steps are managed by evaluation that clarify the result from the care and release patient struggles. These struggles can be recognized and come across the patient as well as his family, this motivate the students toward helping them by production estimation that may cause harm to the patient or family if not provided correctly, instead they must give the correct and accurate care to the patient (Shin and Kim, 2013).

The responsibilities of the tutors in this case, he must be on high observation and work with students to help them by using his cognitive thinking abilities and the skills that be learned must be integrated with care provided during implementation when using scenario-based learning. (A Brunt, 2005). So the tutors responsibilities started from the beginning of assessment till the evaluation of the care provided. In the assessment and recognizing the problem the tutors must work with the pupils to discover the information from the scenario, working to identify the relevant literature tackling same problems, later organized the data from the most important to least important, and using cognitive thinking to plan how to solve this problems in a systematically organizing way. After that, the performance of the plan and evaluating it when discussing and explain about the scenario. The tutor also must be good observer and differentiate between the relevant and non-relevant information, this encourages the students to identify their weak points and direct feedback provided to guide them toward best practice when making decisions. During the implementation the tutor make sure that the students provide the care according what they planned and prioritized this can be done when discussing scenarios this can be explored the accurate interventions that been applied (Shin and Kim, 2013). The essential part from the tutors is to motivate the students toward perfect conduction of the plan that been identified for the care by using high-fidelity mannequins. The difficulties that the pupils can faced during this were how to identify and gather the data relevant to the scenario provided, how can then steps the data from highly importance to lower importance, and including all the plan and data in to implementation process (Nagshabandi, 2018). The vital role of the tutor is to guide the learners and becoming a role modelling when providing help and information. As Stewart (2002) explained that tutors is playing a role in utilizing the cognitive thinking abilities of the learners this

can help them to use their power and cognitive skills toward future career employment. So, the big task of the learners is to work independently as practitioner and uses their cognitive intellectual abilities to solve many problems faced during the employment stage.

The strategical plan of the medical and health professional education toward scenario-based learning:

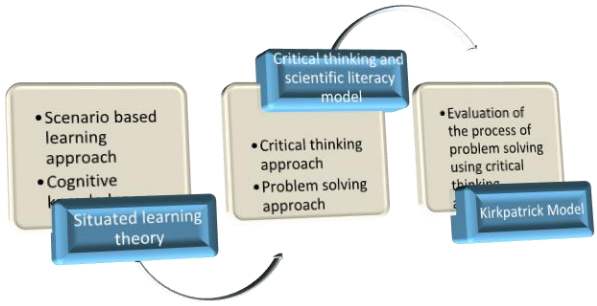
In the medical and health science educational field the strategic plan to boost their cognitive intellectual thinking abilities is required because of dealing with human life and saving them from harming the patient cause them in critical situation. (Shin and Kim, 2013)

SBL uniforms problems may have numerous explanations. Previous and recent studies pointed out that SBL can be folded into main four types of scenarios such as professional debate scenarios, professional hypothetical scenarios, scenarios conveying skills and knowledge, and scenarios for inquiry problems. (Hussein Ahmed, 2019c). Designing the scenario with good and nourished information cause the teachers and students to have real and meaningful experience this cause them to have good cognitive intellectual abilities when facing a real life problem situation during future career. A lot of research studies been conducted on the usefulness of SBL when application on learning and teaching especially for medical and health science students (Nagshabandi, 2018). This guideline of learning style complement the learners with good guidance aims and goals and make bridge between the educational theoretical learning and the performance applied. In addition, the researchers put on eyes on SBL to increase student's capabilities and empowers their skills in analytical, issues solving, collaboration and interaction, and partnership expertise with in the 21st Century (Nagshabandi, 2018). Furthermore, this can make students to be more confident, having a power to face any problems, and encourage them to use cognitive thinking for daily real- life situations. (Hussein Ahmed, 2019c).

Theoretical framework:

The applicable theoretical framework in this research explored in figure1 by three main theories that were situated learning theory, critical thinking and scientific literacy model, and Kirkpatrick Model.

Figure 1: Theoretical framework of the research study:



Note: Figure 1 showed the theoretical framework of the study that included situated learning theory that explained the scenario based learning approach with cognitive knowledge, critical thinking and problem solving approach using scientific literacy model, and Kirkpatrick Model with evaluating process of critical thinking with problem solving.

Situated Learning theory:

Situated learning theory is the main part of contextual learning theory and is the method used for empowering the investment for disclosed learning. The motivation for learners will be built that can empower this can motivate their ability to foster real-world talents, as seen in Figure 2. According to situated learning theory, the main focus of this research was on cognitive knowledge that should be apparent in most situations. Beginner learners should emerge in real-world performance situations when describing the scenario, using thinking capabilities, and performing correctly but with low-risk artefact uses. (Besar, 2018) This is typically a requirement when practicing in the community through social collaboration and organization. (Aletta Mweneni Hautemo and L. Dalvit, 2016).

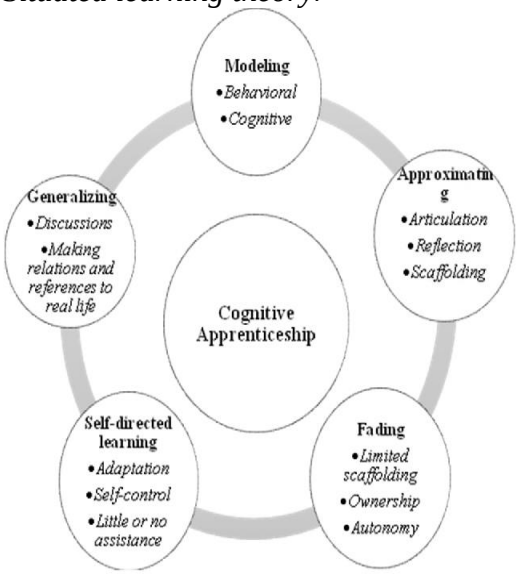
In the research study the constructed scenario-based learning required to include cognitive knowledge that help the students to use their thinking abilities is finding and solving any problem faced during the complicated issues.

Later on, learners moved to another step into more complex and dynamic activities that are built on the first act, finally been as an expert in the position of decision making. Students' ability to

exhibit their talents and capacities is emphasized in situated learning. (Besar, 2018) when providing scenario-based learning the students can have skills that give them the power and self-confidence toward performing the practice in the community settings when learned and have solid-based knowledge. Moreover, it can give learners environmental knowledge that is evocative of the culture and strategies used in situations faced during the issues faced in the life (Hursen and Gezer Fasli, 2017). The cognitive thinking abilities cause the pupils to be able to understand the issues faced by investigate the data that appears in the scenario, and trying to face any challenges faced by elaboration on the issues, concept analyses, mapping these concepts, using brainstorming techniques, so this will help the pupils to grasp the skills performed because the scenario established real-life concepts. They will be at ease in the rehearsal atmosphere when they attend a live performance. As the students after learning from scenario that provided and having practice related to issues mention in the scenario, this can help them to use their cognitive intellectual abilities when facing any problems when caring with real patients in the real- world.

Figure 2:

Situated learning theory:



Note: this figure explains the situated learning theory that the main concept is from the cognitive appearance ship that all the phenomenological concepts are moving around it from modelling, approximation, fading, self-directed learning, and generalization. (Aletta Mweneni Hautemo and L. Dalvit, 2016)

Critical thinking and scientific literacy model:

Critical thinking is part of the main theme of this research study that has been described and referred to the theoretical model, as been defined as scientific literacy by Vic.gov.au (2021) that the theoretical ideas, concepts, phenomena, and contribution steps must be understandable and be applied in the scientific knowledge in community situations after investigation. To improve and build up a good understanding of scientific literacy, the learner must be into and practice knowledge concepts and review the literature to improve their comprehensive abilities to learn and understand the phenomena (Aletta Mweneni Hautemo and L. Dalvit, 2016).

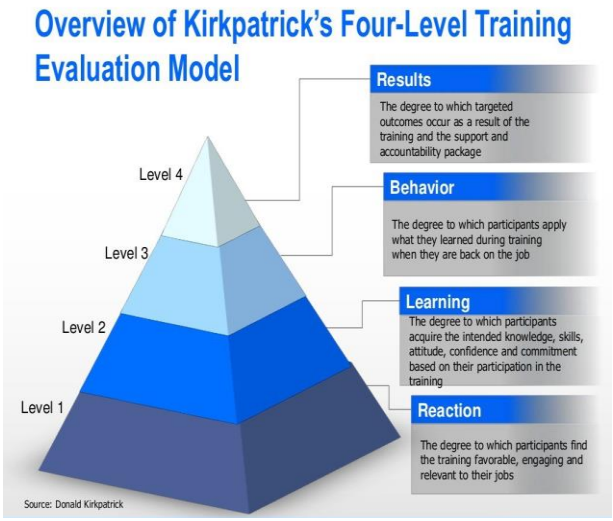
By this approach, the students can be empowered and encouraged to develop their comprehensive scientific-based concepts and knowledge toward best practices and skills that are essential to their future progression in their professional careers. (Vic.gov.au, 2021). Thinking abilities in a critical way are important when it comes to workplace concordat, developing policies and objectives, and standardized data processing. In the field of nursing and health science, however, thinking abilities in a critical way should be worked to characterize the largest way such as interpretative point of view, creativity, independence, resiliency, integrity, dispassionate, recognition, and examination (Khoiriyah and Husamah, 2018). The data must be examined and made standard criteria, and the information must be logical and comprehended while proving care. The development of thinking capabilities in a critical way according to the scientific literacy model started with competency development and knowledge building, which elaborate on the understanding of information and exploring the problems. As well as the determination to use cognitive conceptual thinking in solving issues. (Vieira, Vieira and Martins, 2011). The benefits of this theoretical model represent the abilities of development in educational science that consists of using critical strategies, conceptual knowledge, and the capabilities of cognitive values and moralities, such as capabilities of understanding clinical reasoning. The cornerstone of scientific literacy was to recognize critical thinking abilities, which involve the capacity for conceptual accumulation understanding, and performance to accomplish projects and strategies that are significant in terms of scientific literacy. (Aletta Mweneni Hautemo and L. Dalvit, 2016).

Kirkpatrick Model:

The Kirkpatrick model explained in figure 3 that can be applied to scenario-based learning as a way of gaining knowledge and learning throughout its levels. The levels as the following: level one is the base level that explained the reaction of the participants to be engaged in the activity provided to them and understand it, as when applying scenario-based to the students. The students interact and react toward understanding it and try to find the problem by using their intellectual capabilities. (Sim, 2017). The second level explains the learning acquired from understanding the session given or as in our research can be the learning of the scenario by deeply understanding the complexity of the scenario that has been discussed. As in level three, the participant will apply what they learned and perform certain strategies to commit what has been learned. (Smidt et al., 2009). The final level that is at the top of the pyramid is exploring the results that have been identified and explaining the results that were identified. These levels were sequentially used in scenario-based learning, that first will react toward understanding the scenario this helps the teachers to identify the student's feedback on the practice that has been provided to them. Later on, the participants will try to gain knowledge and data needed to solve the scenario this can be talents, and aptitudes for the students (Sim, 2017). Based on the students' final practice as viewed and assessed by the teachers, teachers can explore the data that has been identified to gain knowledge and identify the gaps in the learning capabilities of the students that are required to be recognized. Level three; that been explained the students will have a behavioral evaluation of how successfully participants use what they learned at training after returning to work. (Smidt et al., 2009). This can be noticed when the performance of the students on synthetic high fidelity mannequins to allowed students to practice before facing the real-world situation in the hospitals. In the last level, to identify the results the teachers will evaluate the students by how well the training is performed, support, and accountability package achieves the anticipated results (KloudLearn, 2020b). These barometers all are proposed for a thorough and evaluation of applicable collaborated knowledge learning, while their implementation gets more complicated that can go in steps by using sequences. (Sim, 2017)

Figure 3:

The Kirkpatrick's evaluation models:

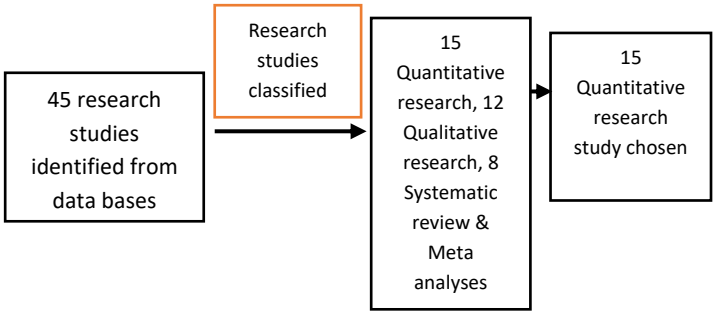


Note: this model is Kirkpatrick's model explains how the evaluation been in sequences from level one in the base till level four in the top explaining the training evaluation model that can be applied to the students when providing scenario-based learning from reaction till identifying the results. (KloudLearn, 2020b)

Methodology:

This research study was a descriptive systematic review with meta-analyses for randomized control trials, quasi-experimental, and qualitative research studies that were conducted from the period of 2008 to 2022. The meta-analyses for 45 research studies in the medical and health science specialty and 15 quantitative research studies were chosen as showed in figure 4. These research examined the analyses from these studies by using Revman Review Manager 5.4 software to identify the influences of scenario-based learning by using critical thinking to solve the problem in the scenarios with randomized control trials using control and experimental groups, also pre, post-test in quasi experimental research studies with descriptive studies and identified the results percentage with significant statistical results. The studies were taken from Google Scholar, CINAHEL, EBSCO, and ProQuest.

Figure 4: Process of research inclusion in the study:



Note: figure 4 showed the process of data chosen from data bases and included in the study that 45 research studies identified from data bases website and been classified to categories of quantitative, qualitative, and systematic review with Meta analyses.

Analyses:

The research studies were chosen after reading 45 research studies and 15 were selected as randomized control trials, quasi-experimental, and descriptive research studies to be included in meta-analyses. Table (1) showed the research study that has been chosen for meta-analyses that were experimental studies contains two groups, control and experimental groups. Also, quasi experimental studies that were consists of pre and post-tests analyses. Moreover, descriptive research studies to identify the statistical percentage of significant of the studies. In these studies explained the sample size, the author who did the study, the themes related to each research study chosen, and the result from each studies. The classification of these studies can be recognized from the themes that devided in to 3 themes that were scenario-based learning (SBL), problem-solving (PS), and critical thinking (CT). Rogal & Young, (2008) did a pre post-test design about using cognitive intellectual thinking abilities in critical care for nursing education, and the participants were selected from postgraduate nurses consists of 31 nurses that were evaluated by the scale of the California critical thinking skills Test (CCTST) scale the result showed a mean pre-test score of 18.5 and post-test 19.7 which indicated higher than established norms in the test that mean the use of critical thinking is essential for the students. Also, another study on critical thinking skills using lecture- based learning compared with scenario based learning in nursing specialities used as explained that is also as the main theme of this research study, that a comparative descriptive survey participants were 65 students from the SBL nursing program and 38 students from the didactic nursing program that showed about the participants who performed cognitive thinking critically using SBL got better scores than participants of the didactic program (Kaddoura 2011). Moreover, an independent variable across within subjects design was worked with the variable of guidance protocol a crossed within-subjects design was employed with an independent within-subjects variable of instructional format (PBL is a subtheme of this research study or lecture) by Pease & Kuhn, (2011) the research study done in sections that was in physics, the samples were pupils in humanities studies that were 62 in part A and 62 also in part B sections. It's showed the deferences between two studies in using PBL team with individuals that were no significance deference's when assessment. Only the deference's were in statistics that was C1, $\chi 2(3) = 14.56$, $p = .002$. In a quasi-experimental study done by Zadeh et al. (2014) participants were 48 students 24 intervention groups trained in evidence-based nursing using scenarios and 24 control groups, both of them were examined and assessed by using questionnaire of California critical thinking the result appeared that proclivity toward cognitive thinking abilities in pupils in group that having scenario with evidence-based is performing better that the other control group ($P<0.001$). Related to Cho, (2015), did a study on the effect of simulation-based learning scenarios by utilizing patient with respiratory problem that can they learn clinical skills from the patient. This exercise let them to be satisfied, competent, and having self-efficacy in health-related department students using a quasi-experimental non-equivalent control group pre post-test. The participants were divided in two groups in equal of 25 pupils of experimental and control groups. For the experimental group of the students, the author gave them 2 education sessions and 1 evaluation session with 180 minutes for each session. The result showed that the effective teaching methodology, in this case, is when using a scenario with simulation-based learning, and it was very effective. This type of learning can cause the students to be competent, and self-efficient related to caring when dealing with real-life situations problems, and patient issues. In the research study Effectiveness of teaching strategies on the development of critical thinking in undergraduate nursing students: a meta-analysis was done by de Oliveira et al. (2016) by using 12 randomized clinical trials, 7 evaluation techniques of problem-solving utilizing scenario results showed the problem-solving technique using cognitive thinking abilities was more effective than lecture as statistically appeared as (SMD = 0.21 and 95% CI = 0.01 to 0.42; p = 0.0434), also related to the meta analyses that showed the studies were homogeneous that statistically showed (chi ^{2}= 6.10, p = 0.106). Furthermore, A

quasi-experimental, longitudinal within-subjects design that 321 third-year medical students participated in the study done by Gaupp, Körner & Fabry (2016). They gave this survey by online pre and post starting the e-learning teaching about patient safety (PS). The measurement out comes was divided in to two first about the thinking and attitudes, second the knowledge about Ps improved by e-learning toward PS. The outcomes of the study appeared Levels of systems thinking showed significant improvement (58.72 vs. 61.27; $p < .001$) after the e-learning. Also, related to the attitudes the improvement appeared in many feature cause them to choose fatigue when performing PS were high according to statistical analyses (6.23 vs. 6.42, $p < .01$). As been discussed by Egenberg et al. (2017) about research study done by him explaining the impact of scenario learning on medical and health science related to post partum hemorrhage that been done in Tanzania. This research was quasi-experimental used 1667 participants from different health care professions working in Obstetric and Gynaecology ward, and 1641 files as a sample of the study that the result showed that its significant association 47% with the rate of blood transfusion depletion. For more support on the influence of problems based on thinking abilities by using a scenario a research study using compared two strategies to teach clinical reasoning done by Linsen et al. (2018), the samples were171 participated in solving clinical cases by using patient experience description and theoretical learning. The researcher gave an assignment for 162 participants to solve the case by showing the video with a group discussion. The study showed no significant between teaching techniques and performance ($p = .23$). A pre-test and post-test without any control group were used as a quasi-experimental design this is another study done for 108 second-grade prospective science teachers in a faculty of education. The result showed no significance in the biology self-efficacy tool between pre and post-test in laboratory activities (Çeliker 2021). Finally, explanatory sequential mixed-methods design study done by Gonzalez et al. (2022), the participants were 52 senior nursing students were divided in to subgroup according to there allocated cognitive thinking abilities. The statistical results showed the students using intervention as way of cognitive thinking abilities development.

Meta-analyses of research studies:

Figure 5 showed that the meta-analyses of the research studies that were chosen clearly to explore and analyze the Influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education showed that all the research participants were 5265 at 100% weightage and risk ration, M-H, random, and 95% CI were 0.78(0.69, 0.89), with heterogeneity $Tau^2 = 0.05$, chi $^2 = 164.88$, and df= 14 ($p=0.00001$) that is highly significant($p < 0.05$). And the total effect was $Z= 3.59$ ($p= 0.0003$) also showed highly significant meta-analyses that there is an influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education. Figure 6 showed the publication funnel plots related to research publication that showed from the figure that most of the research studies were published were 10 studies and 5 studies had some problem in publications, but all the research studies it's around the mean, although, studies were homogenate it needs more research studies to identify the effectiveness of the research studies when shown a funnel that must be more than 15 research studies.

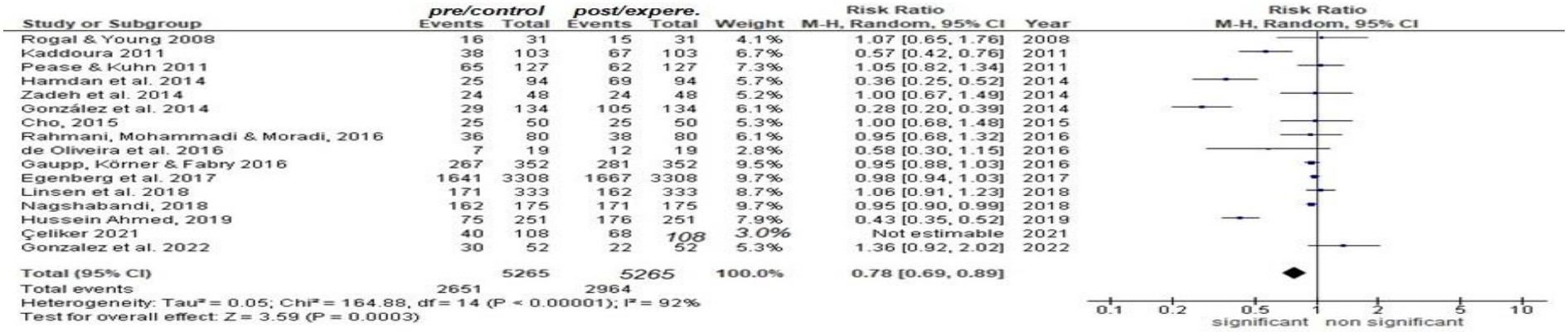
Table 1:

Author and year (country) Theme and subtheme	Type of the study	Sample size	Study sampling method	Result
(Rogal & Young 2008) (Australia) Main theme CT	pretest posttest design	31 postgraduate nurses	That scale assessed by The California critical thinking skills test (CCTST).	The result of the mean showed 18.5 in pre-test and a 19.7in post-test
(Kaddoura 2011) (*USA)* main themes CT	A comparative descriptive survey	103 participants	65 nursing students participated in CBL 38 nursing students participated in deductive program	The results showed the CBL students performed better than the didactic program.
(Pease & Kuhn 2011) (USA) The theme PS	A crossed within-subjects design the differences between (PBL or lecture).	127 undergraduate students	62 students in part A 65 students in part B	Part A (PBL team) showed no significance with part B (PBL individual) only the deference in cognitive thinking . $\chi 2(3) = 14.56$, $p = .002$.
(Hamdan et al., 2014) (Malaysia) Main theme PS	pretest posttest design	94 third year nursing students	Convenient sample methods	Using t-test showed significant differences Scores, also demonstrated that the students' level of satisfaction towards PBL correlated SBL
(González et al. 2014) (Mixico) Main theme PS	A descriptive transversal study	134 second-year Nursing students	The students participated in survey	The participants describe the cases as engaging, effective, practical and varied. 55% of students revealed their preference for traditional methodology compared to SBL. 78% liked this new methodology.
(Zadeh et al. 2014) (Iran) Main theme CT	quasi-experimental	48 nursing students	24 Intervention-group students were trained in evidence-based nursing. 24 control groups were evaluated through the questionnaire of California Critical Thinking Disposition	Showed that the tendency toward critical thinking in students in the intervention group who were trained in evidence-based nursing was significantly better than the thin e control group (P<0.001).
(Cho, 2015) (South Korea) Main theme SBL	quasi-experimental non-equivalent control group pre-post test design	A total of 50 students	25 students for the experimental group and 25 students for the control group,	The result showed simulation-based scenario is better than lecture (SMD = 0.21 and 95% CI = 0.01 to 0.42; p = 0.0434)

(Rahmani, Mohammadi & Moradi, 2016) (Iran) Main theme SBL	A semi-empirical research using pre-test and post-test with the control group	80 student nurses	38 people in the intervention group and 36 in the control group.	The performance score of the nurses for the intervention and control group was 24.32 ± 3.78 and 20.38 ± 3.32 respectively (p = 0.0001).
(de Oliveira et al. 2016) (Brazil) Main theme CT	Control and experimental groups	19 students	The experimental group received the 2 education sessions and 1 evaluation session with 180 minutes for each session.	Levels of systems thinking showed significant improvement (58.72 vs. 61.27; p < .001) after the e-learning.
(Gaupp, Körner & Fabry 2016) (Germany) Main theme CT	A quasi-experimental, longitudinal subjects design	321 third-year medical students	12 randomized clinical trials, 7 studies included that evaluated the strategy of problem-based learning	The result showed that multi-professional, scenario-based training was associated with a significant, 47% reduction in whole blood transfusion rates.
(Egenberg et al. 2017) (Tanzania) Main theme SBL	Quasi-experimental, pre-vs. post-interventional study	1667 participants 1641 files	A survey by using online in pre and post-e-learning about patient safety(PS)	The statistical results showed no significance in teaching techniques and performance (p = .23).
(Linsen et al. 2018) (Netherlands) Main theme SBL, CT	Compared two strategies to teach clinical reasoning.	333 medical students	Medical and health professions working in OBS., GYN. ward	The result showed no significance between 2 groups
(Nagshabandi, 2018a) (Saudi Arabia) Main theme CT	Quantitative descriptive	175 second-year nursing students	171 student using written description to solve clinical cases. 162 students using video to solve clinical cases.	The study result showed majority of students perceived critical thinking process in scenario based learning
(Hussein Ahmed, 2019) (Egypt) Main the SBL	Descriptive research study	251 fourth year students	The students participated in survey	The result showed around 70% of the students' perceived SBL as a very stressful learning method.
(Çeliker 2021) (Turkey) Main themes SBL,CT Subtheme PS	a quasi-experimental design	108 science teachers in education	By using self-efficacy tool with three factors: laboratory activities, the learning level, and solving problems.	The result showed the teachers utilized intervention technique in cognitive thinking abilities.
(Gonzalez et al. 2022) (USA) Main theme CT	an explanatory sequential mixed methods design	52 senior nursing students	Students were scheduled and placed randomly into eight teams based on attributes of critical thinking	The findings indicated participants perceived the intervention as a strategy for developing critical thinking

*Note***:** table 1 explain all research study article that is discussing the influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education by identifying the sample used and explaining the methodology of the research study that has been conducted. Finally, the result from each research study. Also, this table mentioned and connected with the theme and subtheme of the research study.

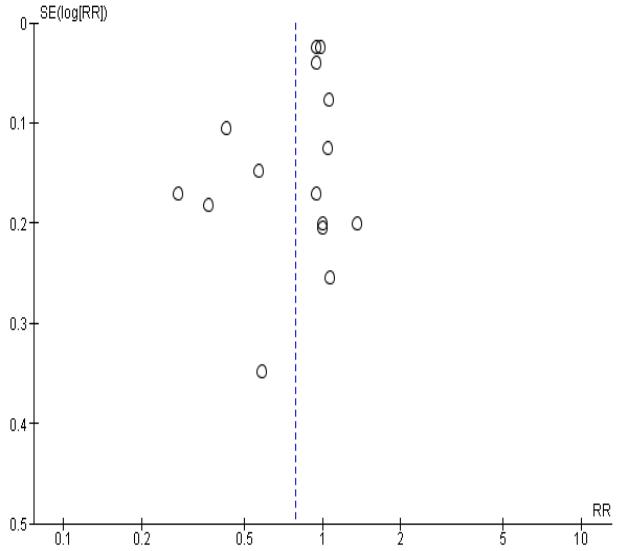
Figure 5: *Meta-analyses of research studies:*



Note: This figure Explore and analyze the Influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education from a systematic review, that showed heterogeneity and highly significance (p=0.0003)

Figure 6:

Publications data funnel plots of the research study:



Note: this figure shows the funnel plots about the researches discussing the Influence of Scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education, which showed all is around the mean but not a clear picture about the research because of fewer research numbers.

Discussion:

Scenario-based learning is an important aspect of learning and teaching especially in medical and health science, as shown in the meta-analyses of all research studies that tackled the influence of scenario-based learning on problem-solving using a critical thinking analysis approach that showed significance and heterogeneity with the result of as discussed in analyses. Moreover, the main themes of the research study were SBL and CT, and the subthemes were problem solving, plan of action, and implementation of plan to care provided. Maintaining the empowerment of cognitive thinking abilities by using it in clinical management's is the essential goal of medical and health science education ((Rahmani, Mohammadi & Moradi, 2016; Zadeh et al. 2014). Also, he explained that the pupils in the hospitals must have the knowlede and understanding when collecting informations and refere it to cognitive thinking in performace of the plan of action. Those pieces of data gathered is helping them to employ in variety of solutions. (Zadeh et al. 2014; (Gonzalez et al. 2022). This can support the theory of Situated Learning theory and Kirkpatrick Model. that in both theories were the students will face defferent situation and their will be process of cognitive thinking and the reaction related to the situation faced, this can give the students more self-steam and cofedence when dealing in the real situation. Scenario-based learning can be effective when supported using mannequins that show them the reality before going to the hospital for training (Linsen et al. 2018). This can prevent patient harm and increase safe practice during clinical training (Gaupp, Körner & Fabry 2016). the tutor must reinforce the students causing them to use their critical thinking that can empower and improve their practice as well as self-confidence enhancement. Scenario formation that can prominent element in critical thinking; the more extensive is the individual's information, the more capable in critical thinking. (Zadeh et al. 2014). As showed in the analyses that the critical thinking is most important element in understanding scenario and, encourage students toward best practice. This is the main two themes of the study that is important to be utilized well, so the real life situation can be faced in power and knowledge to solve any issues.

Basic knowledge in medical and health science provides them with a general outlook on the patient's needs. The depth and the extent of this knowledge affect the students' ability to think critically and solve nursing problems. (Linsen et al. 2018). The training, which included the participation of all students, and the scenario-based learning cause them to imagine the real-life situation with the help of high fidelity mannequins the students can perform in safe and good manned when facing patients in the hospitals (Rahmani, Mohammadi & Moradi, 2016).

the scenario-based learning cause the students to be having experience on objective learning, encourage them on reflective learning, and helping them in strong focus on teams by team working, lastly

patient management. Also, training 2 months after the second simulation training. The doctors might have considered the simulation training of less importance to them compared to the medical and health sciences students. (Egenberg et al. 2017). As training is part of scenario identification and increasing knowledge related to the case this can help in solving problems by critically thinking and guide the students toward safe practice during clinical training when dealing with patients (Kaddoura 2011). Furthermore, using simulation

will support understanding the scenario and provide more details information toward problem-solving when practiced (Cho 2015) that when compared to lecture-based learning with scenario-based learning using problem-solving that showed statistically significant. (de Oliveira et al. 2016).
To support the research study the instructors play a vital role in supporting the students and encouraging them to use critical thinking to solve the problem faced during the training (Çeliker 2021) this can help the students to identify the gap and reduce their tension when dealing in a real situation. (Gonzalez et al. 2022)
As this research study supported the influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education when analyzing the data from research studies that support the author's idea and showed significant results, there is a limitation in this study that only 15 research articles were discussed and analyzed and more research studies can be taken to support the research study. Moreover, the funnel plots were not clear that the plots are around the mean but need more studies to show if it supports the research study.

Recommendation:

The recommendation of this research study is to have more studies discussing the same problem related to scenario-based learning and, utilizing critical thinking by using empirical studies. To identify researchers that have been tackling scenario-based studies mostly, because can show more information results toward this research study. Furthermore, more studies needed that tackling the development of new strategies in teaching and learning to differentiate the deferent types of learning and education that develops the cognitive thinking abilities of the students, and support the theoretical and conceptual framework in multidimensional learning methodologies.

Conclusion:

In conclusion, this research study discusses and explores the influence of scenario-based learning on problem-solving using a critical thinking analysis approach in medical and health science education by using systematic review & meta-analyses of experimental, quasi-experimental, descriptive research studies. The analyses of the study is supporting the research study with heterogeneity results and it's highly significant. Also, most of the research studies supported this research study that scenario-based learning is highly important in learning and teaching in medical and health science specialty and this can help them before going to the training in the hospital with support with high fidelity mannequins can reduce students' stress and anxiety when dealing with real patient and not causing harm to him as explained by Egenberg et al. (2017) and Rahmani, Mohammadi & Moradi, (2016).

References:

Aletta Mweneni Hautemo and L. Dalvit (2016). *Situated Learning: A Theoretical Base for Online Learning - Wikipedia Translation into Oshikwanyama at a Namibian school*. [online] undefined. Available at: https://www.semanticscholar.org/paper/Situated-Learning%3A-A-Theoretical-Base-for-Online-at-Hautemo-Dalvit/c0828034f78f1e4bb044cc716de9df4d57b23cab [Accessed 1 Jun. 2022].

Bastable, S. (2019). Nurse as Educator: Principles of Teaching and Learning for Nursing Practice. 5th ed. Burlington, Massachusetts: Jones & Bartlett Learning.

Çeliker, H. D. (2021). Problem-based Scenario Method with Experiments: Determining the Prospective Science Teachers' Biology Self-efficacy and Critical Thinking Tendency. *Science Education International*, vol. 32(1), pp. 23–33 [online].Available at: http://www.icaseonline.net/journal/index.php/sei/article/view/262.

Cho, H.-Y. (2015). The effect of Simulation-based learning scenario using standardized respiratory patients on learning satisfaction, clinical skill competency and self-efficacy in Health-related department students. *Journal of the Korea Academia-Industrial cooperation Society*, vol. 16(3), pp. 2100–2108.

de Oliveira, L. B., Díaz, L. J. R., Carbogim, F. da C., Rodrigues, A. R. B. & Püschel, V. A. de A. (2016). Effectiveness of teaching strategies on the development of critical thinking in undergraduate nursing students: A meta-analysis. *Revista da Escola de Enfermagem*, vol. 50(2), pp. 350–359.

Egenberg, S., Masenga, G., Bru, L. E., Eggebø, T. M., Mushi, C., Massay, D. & Øian, P. (2017). Impact of multi-professional, scenario-based training on postpartum hemorrhage in Tanzania: A quasi-experimental, pre- vs. post-intervention study. *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, vol. 17(1), pp. 1–11.

Elliott-Kingston, C., Doyle, O.P.E. and Hunter, A. (2016). Benefits of scenario-based learning in university education. *Acta Horticulturae*, (1126), pp.107–114. doi:10.17660/actahortic.2016.1126.13.

Explore the eLearning world with us. (2019). *Scenario-Based Learning 101: What, Why and When*. [online] Available at:

https://www.ispringsolutions.com/blog/scenario-based-learning.

Gaupp, R., Körner, M. & Fabry, G. (2016). Effects of a case-based interactive e-learning course on knowledge and attitudes about patient safety: A quasi-experimental study with third-year medical students. *BMC Medical Education*. BMC Medical Education, vol. 16(1), pp. 1–8.

Gonzalez, H. C., Hsiao, E.-L., Dees, D. C., Noviello, S. R. & Gerber, B. L. (2022). Promoting critical thinking through an evidence-based skills fair intervention. *Journal of Research in Innovative Teaching & Learning*, vol. 15(1), pp. 41–54.

González, C., Carbonero, M., Lara, F. & Martín, P. (2014). Nursing students' satisfaction in Problem-Based Learning/Aprendizaje Basado en Problemas y satisfacción de los estudiantes de Enfermería. *Enfermería Global*, vol. 13(3), pp. 105–112 [online].Available at: http://search.proquest.com/docview/1664837249?accountid=14477%5Cnhttps://nevada.ual.es/biblioteca/gtb/sod/poa_login.php?centro=$UALMG&sid=$UALMG&title=Enfermería+Global&atitle=Nursing+students'+satisfaction+in+Problem-Based+Learning/Aprendizaje+Bas.

Hamdan, A.R., Kwan, C.L., Khan, A., Ghafar, M.N.A. and Sihes, A.J. (2014). Implementation of Problem Based Learning among Nursing Students. *International Education Studies*, [online] 7(7). doi:10.5539/ies.v7n7p136.

Hursen A.C., Fasli, F.(2017) Investigating the Efficiency of Scenario-Based Learning and Reflective Learning Approaches in Teacher Education. *European Journal of Contemporary Education*, 6(2). doi:10.13187/ejced.2017.2.264.

Hussein Ahmed, H. (2019). Adopting Scenario Based Learning in Critical Care Nursing Education: Students' Achievement and Feedback. *American Journal of Nursing Research*, 7(4), pp.581–588.

Jamshidi, H., Hemmati Maslakpak, M. and Parizad, N. (2021). Does problem-based learning education improve knowledge, attitude, and perception toward patient safety among nursing students? A randomized controlled trial. *BMC Nursing*, (2021) 20:70 pp 1-9 https://doi.org/10.1186/s12912-021-00588-1

Kaddoura, M. A. (2011). Critical Thinking Skills of Nursing Students in Lecture-Based Teaching and Case-Based Learning. *International Journal for the Scholarship of Teaching and Learning*, vol. 5(2).

Linsen, A., Elshout, G., Pols, D., Zwaan, L. & Mamede, S. (2018). Education in Clinical Reasoning: An Experimental Study on Strategies to Foster Novice Medical Students' Engagement in Learning Activities. *Health Professions Education*. Elsevier B.V., vol. 4(2), pp. 86–96.

Nagshabandi, E.A.A. (2018a). Nursing Students' Perception Towards Critical Thinking Process Of Knowledge And Skills At Kau. *Social Science Learning Education Journal*, 03(05), pp.53–59. doi:10.15520/sslej.v3i5.2137.

Pease, M. A. & Kuhn, D. (2011). Experimental analysis of the effective components of problem-based learning. *Science Education*, vol. 95(1), pp. 57–86.

Papathanasiou, I., Kleisiaris, C., Fradelos, E., Kakou, K. and Kourkouta, L. (2014). Critical thinking: The development of an essential skill for nursing students. *Acta Informatica Medica*, [online] 22(4), p.283- 286 doi: 10.5455/aim.2014.22.283-286 Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4216424/.

Rogal, S. M. & Young, J. (2008). Exploring

critical thinking in critical care nursing Education: a pilot study. *Journal of continuing education in nursing*, vol. 39(1), pp. 28–33.

Rahmani, A., Mohammadi, A. & Moradi, Y. (2016). Effectiveness of scenario-based education on the performance of the nurses in the critical cardiac care unit for patients with acute coronary syndrome. *International Journal of ...*, pp. 218–224 [online].Available at: https://www.indianjournals.com/ijor.aspx?target=ijor:ijmrhs&volume=5&issue=8&article=034.

Rogal, S. M. & Young, J. (2008). Exploring critical thinking in critical care nursing education: a pilot study. *Journal of continuing education in nursing*, vol. 39(1), pp. 28–33.

Sayyah, M., Shirbandi, K., Saki-Malehi, A. and Rahim, F. (2017). Use of a problem-based learning teaching model for undergraduate medical and nursing education: a systematic review and meta-analysis. *Advances in Medical Education and Practice*, Iran. Volume 8, pp.691–700.

Shin, I.-S. and Kim, J.-H. (2013). The effect of problem-based learning in nursing education: a meta-analysis. *Advances in Health Sciences Education*, ResearchGate. [online] 18(5), pp.1103–1120. Available at: https://link.springer.com/article/10.1007/s10459-012-9436-2.

Stewart, T. (2002). SCENARIO-BASED LEARNING What is scenario-based learning? *University of New Zealand* [online].Available at: http://www.astd.org/.

Zadeh, H. H., Khajeali, N., Khalkhali, H. & Mohammadpour, Y. (2014). Effect of evidence-based nursing on critical thinking disposition among nursing students. *Life Science Journal*, vol. 11(9 SPEC. ISSUE), pp. 487–49