

Effectiveness and Challenges of Mastery Learning in Nursing Education: A systematic review

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Abstract

Introduction: As a large part of human resources in the health system, nurses play an important role in promoting public health. One of the ways to provide better health services is training qualified nurses. This is why mastery learning would be one of the most effective educational approaches to realize it. Despite its numerous advantages, the implementation of mastery learning is facing challenges. This study is to examine the effectiveness and the challenges of mastery learning.

Methods: This study is a systematic review with an extensive search to find articles from Persian and English databases using the keywords of “education”, “health care research”, “evaluation”, “mastery learning”, “medical education”, and “nursing education” either alone or in combination with each other in the websites of Cumulative Index of Nursing and Allied Health Literature (CINAHL), Scopus, Medline, Embase, PsycINFO, and SID. In this regard, 138 research papers published from 2005 to 2015 which were in line with the research question were found. After an examination, 16 articles were included in the study. The data from the articles were summarized, classified and analyzed based on the research question.

Results: Although mastery learning increases the educational effectiveness, its implementation for reasons such as the applicability to some subjects, time consumption, learners’ various individual characteristics, talented students’ lagging behind other learners, frequent formative assessments, and frequent test-designing require more efforts both by the teacher and the learners.

Conclusion: Students raised through this method are competent students having the minimum requirements to perform their duties in the future. Therefore, proper curriculum design, introduction of this approach to teaching institutions and learners, empowerment Of teachers, and pilot studies related to the solutions to address its challenges could help in exploiting this approach in theoretical and clinical education.

Keywords: Mastery learning, Nursing education, Competency-based education

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Introduction

Universities are considered as the most important educational institutions, the centers of science and culture as well as training the specialists needed in a country, creation and production of new knowledge, or furthering the frontiers of knowledge. Three major missions have been assigned to universities: education, research, and service. The mission of education is regarded as the first mission agreed upon in many countries. Education is a targeted training activity to promote learning and the role of educational institutions is training and development of students. In the academic education system, education means making appropriate and increasing changes in the product of this system i.e. the graduate (1).

Education plays an important role in shaping students’ basic skills and professional abilities through different methods. Among these methods we can point out to mastery learning (2). Mastery learning is one of the individual learning styles (3) that was introduced by John Carroll more than eighty years ago (4). John Carroll believes what distinguishes different learners is the time needed to learn (5). In other words, in Carroll’s model, learning in the classroom is a time-based phenomenon so that the more the time is devoted

to learning, the more the learning rate will become (3). Although the mastery learning method is mainly an individual method of learning, this type of teaching is also administered in group that is by a teacher and several learners. In other words, in this teaching method, all learners receive the basic education from the teacher and progress in group during the lesson from one unit to another. However, this method has fundamental differences with the conventional group teaching (6 and 7). The purpose of this type of learning is providing a perfect environment with respect to the learners’ differences. Thus, these differences will not be an obstacle to fulfill learning goals (8).

Education systems make an attempt to create equal learning opportunities for all learners (3). Medical education is part of the higher education system that deals with human life and attention to its qualitative and quantitative aspects is of particular importance (9, 10). Since the public health depends on the quality of services, prevention, education, and treatment, and given the important role of the medical team as an effective member in the delivery of social services and emphasis on education of the public; the need for an academic and professional disciplined system including university as the actual context of training



manpower is undeniable (9, 10). The purpose of medical education at universities is the creation of self-directed learning, improvement of psychomotor skills, time management skills, increased self-confidence, good communication, and prevention of student passivity (10). Success in this direction requires the adoption of effective approaches in association with new knowledge and tailored to the needs of clients and patients, that prepare students in a helpful way (11). In this respect, each stage of knowledge attainment requires a specific type of learning or a specific approach and accordingly the education system facilitates learners' access to specific educational purposes (5, 12). In recent years, great strides have been made to improve the materials in educational programs and teaching methods. Evidence suggests that some of the methods are more efficient than other ones and lead to more learning in students. However, one of the main problems for teachers is how to select appropriate teaching methods and how to enhance students' learning progress and motivate them to learn (13). The main objective of nursing education is teaching students to use the skills learned and apply them correctly in patient care based on science and art. Nursing education needs scientific basis and ability in appropriate practical and clinical skills (14); so that healthcare organizations such as the World Health Organization also call for the promotion of standards for new nursing graduates compared to graduates in the past (1). Unfortunately, in recent years, nursing education has been more focused on theoretical education and this has led to a widening gap between theoretical and practical education. Numerous researchers have reported that nursing students, despite having appropriate knowledge, lack good skills. As a result, the entrance of these non-skilled individuals to therapeutic centers means that every day these systems are faced with more quality loss (15).

Since the minimum expectation from the nursing education system is that all nursing graduates have a high level of clinical skills and professional competencies and due to the limited number of studies regarding the use of mastery learning in nursing education, this study was designed to address these questions: firstly, is mastery learning effective in nursing education?; secondly, what are the challenges to this approach in nursing education system? in order to have a comprehensive understanding and consider appropriate solutions for its implementation.

Methods

Data were searched and extracted based on University of York Center for Reviews and Dissemination Guidance 2008. Systematic review of literatures involves the following steps according to the above strategy:

1. Formulating a primary search question that specifies the purpose of systematic review of literatures.
2. Search strategy in databases
3. The criteria for selecting studies
4. The tools to assess the quality and evaluation of studies
5. Selection of studies in accordance with inclusion criteria
6. Extraction of textual data and analysis
7. Finally, combining them together

Primary search questions include the following two questions:

- 1- Can mastery learning be effective in nursing education?
- 2- What are the challenges of this approach in nursing education?

Using a systematic and purposed review in this study with a focus on the research questions, an extensive search was done to find articles in Persian and English databases using the keywords of "education", "health care research", and "mastery learning" from the websites of CINAHL, Scopus, Medline, Embase, PsycINFO, and Elsevier. These words were often used individually and in some cases a combination of two words was employed. The search was limited to the time period of 2005 to 2015. About 138 articles were found and the duplicate titles were removed. Emphasis was placed on empirical, descriptive, and review studies in the field of mastery learning; and anonymous, unscientific, and the cases inconsistent with the title of this research or written in the languages other than English and Persian were excluded. Other Exclusion criteria included editorial report, commentary, bulletin, book review, short report and introductory. Items such as introduction of books, magazines and conferences report were excluded from the study because they lacked ability to answer the research question such as limitation and lack of qualitative evaluation.

The check list of evaluating papers was chosen suitable for the question and objective of the research and in accordance with instructions included in the strategy adopted by the research team of the University of York. N papers that could respond to the question of the study were entered to the stage. The original articles were retrieved and critically studied and evaluated in accordance with the evaluation checklist and only the papers enjoying all standards of checklist could participate in the study.

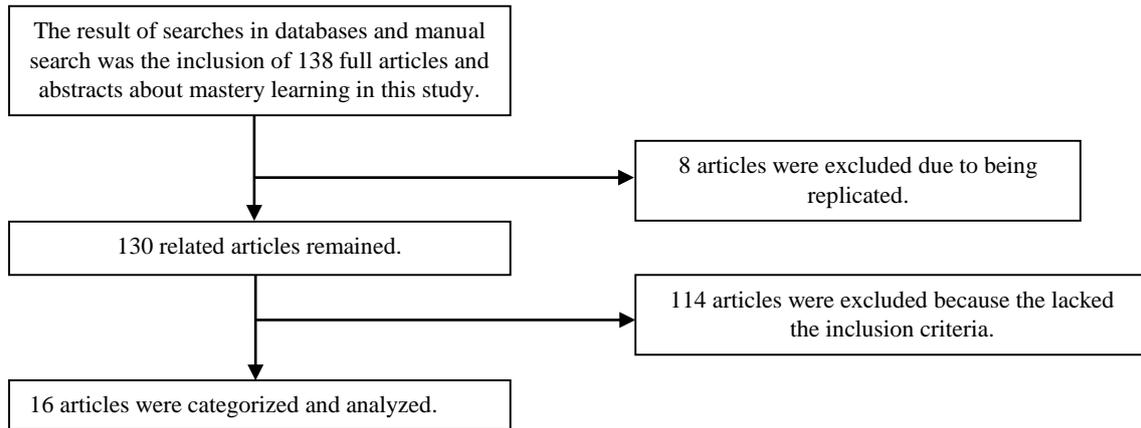
As shown in Figure 1, after the removal of the articles that were not eligible for this study, 16 articles were included. Then, in order to extract and synthesize the data, articles were read by one of the authors in detail, and the most important points in line with the purpose of this study were summarized and extracted. Finally, the findings were reported based on the contents of the themes obtained. In order to increase the accuracy of the study, the obtained data were controlled and reviewed by other researchers in the research team. Figure (1).

Results

In this section, based on the method of York, textual data were extracted, analyzed and finally combined. In this case, the results of data analysis and interpretation obtained from papers and Table (1) were classified and in line with research questions in two categories of "Effectiveness" and "Challenges of mastery learning in nursing education".

1. The Effectiveness of Education through Mastery Learning

The mastery learning method is effective in the determination of the professional competence in nursing practice, establishment of the criteria for measuring competence,

Figure 1. The process of reviewing and selecting the articles

diagnosis of nursing students' learning needs, presentation of a variety of experiences in different situations, frequent assessments at given intervals, therapeutic activities, and evaluation of achievement to nursing qualifications (16). This method has a positive effect on the academic achievement of students, especially poor ones. In terms of emotional objectives, the study results revealed that the educational method of mastery learning leaves a positive impact on learners' attitudes and interest towards the academic subject (17) and when the procedure is properly applied, it can largely eliminate the existing gaps in fulfilling the objectives and skills (18). Providing students with unlimited opportunities, this approach also allows them to show their control over the taught contents. Therefore, it is a flexible approach that allows students to progress at a rate based on their own understanding (19). In other words, the same time to learn is considered for all learners in the traditional education and different levels of mastery are created. This is while in the mastery learning approach, the same level of mastery is created by granting different times to learners which is an available alternative to traditional methods (8). As a whole, to reach higher levels of learning via mastery learning is the main objective for all students (20).

The proponents of mastery learning have pointed out the advantages of this approach, such as the promotion of a large number of learners, focus on content and main points, identification of students and provision of help, academic efficacy and excellence, and learning the whole content before starting another one. In several studies, the effectiveness and efficiency of this method in the better learning of students in the field of medical sciences like learning advanced CPR by medical students, lumbar spinal puncture by medical residents, teaching vital signs by nursing students, and operating room and procedures have been approved (8, 15, 17, 21, 22, 23, 24, 25, 26, 27, 28). Since the profession and the public require the medical staff who graduate with high and uniform levels of ability, the teaching method of mastery learning prevents the reinforcement of a group of students and the ever-increasing weaknesses of others (29).

2. Challenges of Mastery Learning

In contrast, the critics of mastery learning have mentioned

several defects. In this respect, they have considered this approach suitable for the academic subjects whose components are of a logical sequence not for subjects lacking such a sequence.

The main disadvantage of this method is the amount of time required to deliver all students mastered. Providing this time is not easy. Another disadvantage of mastery learning is that this approach is to the benefit of weak learners but against all the strong ones. In other words, in this way, poor learners progress through corrective education, but strong learners linger for the achievement of poor learners as this leads to kind of lagging. The critics of mastery learning call this negative point, "Robin-Hood Effect" which refers to a legendary character who took the wealth from the rich and gave it to the poor. It is stated that mastery learning is just the same as what Robin Hood did, that is educational resources including time and teacher's attention are denied for strong learners and bestowed to the weak ones. Despite extreme criticisms, mastery learning, in terms of helping all students reach the predetermined criteria of academic achievement, is an effective method (7, 8, 15, 18, 19, 29, 30). Some believe that frequent assessments are associated with student anxiety (15). As feedbacks, correctives and enrichment activities would lead to teaching less materials; the volume of contents is sacrificed for mastery (18). Although assessments and correction activities require a lot of time, they reduce the time to achieve mastery (28).

However, some argue that since learners spent more time on learning, they progress faster than students taught by traditional methods. A teacher can solve this problem through setting up the time; that is, allocating more time in the early stages and less time in the later stages (18). According to the above-mentioned issues, although mastery learning increases the effectiveness of mastery learning, its implementation requires more time and effort by teachers and learners. Nevertheless, institutions are not often prepared to do so (8).

Discussion

Accordingly, to answer the first question of the research about the effectiveness of mastery learning, it can be argued that since this method is useful in improving skills, it enjoys applicability in Clinical Nursing Education.

In general, limited studies have been conducted in terms of

mastery learning approach in nursing education and there was no article examining specifically the challenges to this approach in the time period of 2005 to 2015. This study was conducted to determine the effectiveness and the challenges of mastery learning approach. The benefits of this approach in a review article have been mentioned including creating a shared understanding of information between students, ensuring that students create their own knowledge, motivating students to learn in a constructive developmental feedback, encouraging students to achieve team success and help each other, and helping individuals' group understating so that they are accountable to each other and the entire group is considered as a separate unit (31). This review suggests that the largest use of this approach is in the psychomotor area, so it is of high usability in practical nursing education. Given the importance of this method in the clinical practice of nursing students, Rahmani suggested that nursing educators use this technique as a basic clinical teaching method to provide learners with the fundamental nursing skills and techniques as well as residency. In his view, mastery learning in clinical education does not take more time and this problem may exist in theoretical education, because clinical education is performed in groups with small numbers of students. The content of the clinical education is far less than the theoretical content. In his study, students taught with this approach gained higher scores in carrying out the procedure (15). Although the frequent assessments may cause anxiety in students, it is followed by increased self-confidence among them (15, 27). in response to the second question of the research that is the challenges of this method in nursing education, items such as time-consuming nature, frequent assessments, preparing and familiarizing managers and educational institutions with this method can be pointed out.

Similar to other methods, this approach has shortcomings. The major challenge of this approach is that it is time-consuming. However; if applied in a flexible manner, less time is needed than that spent in traditional methods. Even in a study, although the time spent on education was equal in both groups, the mastery learning group received a higher score (15). Although this method is time-consuming, it accelerates learners' achievement to mastery. In addition, a teacher can partly overcome this problem by devoting more time at an early stage of teaching and less time in the process of student's approach to mastery.

The role of the teacher in this approach is vital and without teacher's intervention achieving success impossible to (31). Since the mastery learning theory is included as one of the behavioristic theories (32) in which observable behavior is the working basis; a teacher is in charge of determining educational goals and converting them into precise and behavioral objectives (5, 23). Studies conducted in some universities in Iran have shown that most nursing students prefer the use of active and new educational methods to the traditional and passive ones and they are willing to use them (17). The dominant feature of university classes is in such ways that much of the materials are presented by teachers and students have a minimal role in the learning process and they are only mere listeners. This makes the essence of university education somewhat similar to school education.

Among the consequences of these traditional methods are students' passivity, forgetfulness of materials, students' fatigue, lack of sufficient time for questions and problems, and demotivation (17). However, new approaches such as mastery learning establish a good interaction between learners and teachers and the comprehensive mental accumulation of bulk materials is not intended. Here, the main purpose is to help students achieve mastery. In this approach, the teacher is a facilitator using ongoing assessments and corrective actions to help learners achieve mastery and thereby increase self-confidence. In order to accomplish this, training teachers on how to implement this approach is of importance. Therefore, holding workshops to empower teachers should be considered. In this way, strong students may stay waiting for other students. But it must be noted that this method is flexible and a teacher in some cases can use individual or group techniques in the clinical education of procedures which do not have the limitations of the classroom. However, in this way, students learn that their success is dependent on the success of the group and this change of attitude, given the importance of teamwork in nursing, plays an important role in their future profession. In addition, they learn knowledge-sharing and group activities. Mastery learning is a key to promote advances in education and a help to develop the chain between the teacher, the curriculum, and the learner (31). This belief highlights the importance and the review of nursing curriculum and its orientation towards providing a suitable base for an emphasis on mastery and not mere memorized materials. However, it should be noted that this approach has not fulfilled all the educational objectives. If medical professors want to teach new skills to the students, they can use mastery learning and behaviorism; but if they want to teach critical thinking, clinical contents, and lifelong self-centered learning, they should use knowledge-oriented, problem-solving and decision-making based on constructivism theory (24, 33).

Conclusion

The purpose of nursing education is developing an appropriate level of knowledge and skill in nursing students and of the most important factors to achieve this objective is the promotion of clinical education level in nursing. Nurses who will be in charge of public health maintenance and promotion as well as the prevention of diseases in the future are students at present, so nursing educators bear a heavy responsibility towards them and they need to focus their utmost attempts on improving and enhancing the quality of nursing education especially in the field of clinical education.

In this regard, education through mastery learning as a very significant method can be associated with successful learning experiences and most learners can learn regardless of their physiological limits. It is a powerful approach that can be used to teach adult learners. It is also a direct, optimistic, and clear approach that gives a teacher the role of a helpful stimulus that has a positive effect on students' self-esteem. Since the accountability of systems for quality, safety, and competence is the public right and demand, mastery learning can be used for the required scientific,

technical, and behavioral qualifications in order to play a professional role. Students trained in this way are competent and can ensure that they have the minimums necessary to carry out their future tasks and duties.

Since in this method, mastery is a prerequisite for the presentation of new contents; the authors of this study

believe that it can be a successful and flexible approach in providing safe and sound education. Moreover, teachers who are aware of this approach can transform the existing challenges in this approach to constructive opportunities to enhance nursing education.

Table 1. Specifications of articles imported into the systematic review

List	Author	Running title	Participants	Methods type	Main Results & conclusion
1	Norozi 2011 (17)	Effect of Teaching Using a Blend of Collaborative and Mastery of Learning Models, on Learning of Vital Signs	52 students in the first semester of nursing and operating room	A quasi-experimental study	Integrated teaching method was a combination of the two educational models of collaboration and mastery learning. In contrast with the traditional method, this approach has been more effective in the promotion of knowledge level, understanding and application of the nursing students and the operation room, as well as their satisfaction with learning the vital signs in the principles and techniques course. However, due to the effectiveness of traditional methods, this method can be used provided that the conditions are met.
2	Shekari Kashani 2009 (13)	The effect of learning and mastery on attitude , performance and intrinsic motivation	46 second-grade students from a high school	experimental study	Mastery learning increases students' intrinsic motivation to achieve higher levels of learning chemistry by making positive changes in students' attitudes towards learning chemistry and increasing their performance at higher levels of learning chemistry.
3	Wayne 2006 (20)	Mastery Learning of Advanced Cardiac Life Support Skills	41 second-year residents at the University of Chicago,	quasi-experimental study	Performance improved significantly after using the training simulator. All residents have gained competence in CPR.
4	Barsuk 2012 (26)	Simulation-based education with mastery learning improves residents' lumbar puncture skills	58 medical residency students after the second year	quasi-experimental study	Competencies of the internal medical residents increased from 43.3 percent to 95.7 percent. The performance of neurology residents via the traditional method was lower than those of the educated residents.
5	Barsuk 2010 (27)	Central Venous Catheter Insertion Skills After Simulation-Based Mastery Learning.	41 internal residents	cohort study	Mastery learning leads to the placement of central venous catheters in the intensive care units and the reduction of the number of needle passes during actual procedures. These educated residents had better confidence in their skills, practices, and procedures.
6	Haghani 2011 (5)	learning theories and its applications in medical education.	review of 47 studies in the time period of 1990 to 2011	narrative review	None of the learning theories are perfect and put emphasis on particular types of learning, so teachers should be familiar with all these theories. In general, appropriate behaviorism of learning new skills, appropriate cognitive teaching of critical thinking, clinical thinking, and lifelong self-directed learning, and proper constructivism are helpful in problem-solving skills, clinical decision-making, and communication skills (5).

7	Cook 2013 (36)	Mastery learning for health professionals	82 studies	Meta-analysis	Evidence showed that mastery learning is more dominant than non-mastery one but it takes more time.
8	Barsuk 2009 (24)	Mastery learning of temporary hemodialysis catheter insertion	8 flows of nephrology in three medical-educational centers	observational cohort study	The performance of the flow of nephrology increased in the first year from 29.5 percent to 88.6 percent after training. This program shows a practical and reliable mechanism to achieve competencies in procedures.
9	ShafeiPour 2011 (34)	A Model to Evaluate Factors on Curriculum	360 teachers	descriptive study of correlation	The research results revealed that attention to mastery learning, individual differences, and research orientation have been central to overall effectiveness of the curriculum among the variables under study.
10	Kazu 2005 (35)	Effects of Mastery Learning Model on the Success of the Students .	87 students who attended the Usage of Basic Information Technologies course	case-control study	The results showed a significant difference between the case and the control groups. Mastery learning led to students' success.
11	Shafie 2010 (4)	Mastery Learning Assessment Model in Teaching and Learning	30 mathematics students	experimental study	Majority of students were content with this approach. There was a positive correlation between the score of this model and the final score.
12	Wambugu 2008 (19)	Effects of Mastery Learning Approach on Students' Physics Achievement	161 students Secondary School	quasi-experimental study with Solomon four-group design	The rate of achievement to success in the mastery learning group was significantly higher than the group receiving higher conventional education.
13	Mohd Hasril 2015 (28)	The Effects of a Mastery Learning Strategy on Knowledge Acquisition	80 students in vocational skills center	experimental study	Mastery learning strategies compared to traditional methods are significantly associated with increased learning in vocational training. Trainees who have received faster feedbacks are more successful. Although this method requires a lot of time but it reduces time to gain mastery.
14	Rahmani 2007 (15)	Comparison the effect of two clinical teaching models on performance of nursing students	51 senior nursing students	quasi-experimental study	The experimental group taught by mastery learning in terms of clinical training compared to the control group received higher scores in all evaluated procedures. In clinical education, mastery learning does not require more time so it is applicable.
15	Jain 2015 (31)	Improving Student Achievement through Mastery Learning	22 studies	Systematic review	In the mastery learning method compared to other traditional methods; time, attention, and sufficient help are given to the learner, and the implementation of this strategy will lead to further learning and better academic performance.

16	Roberts 2013 (16)	Implementation of mastery learning in nursing education.	14 studies	narrative review	This method is useful in determination of the professional competence of nursing practice, establishment of criteria for measuring competence, diagnosis of nursing students' learning needs, presentation of a variety of experiences in different situations, repeated assessment at given intervals, therapeutic activities, and evaluation of achievement to nursing qualifications. But, the major challenge of this approach is being time-consuming due to the organization of various tests and the high volume of nursing education contents
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References

- farajzadeh Z, Rakhsh Khosid M, Izadpanah A, Saadatjoo S. Factors affecting quality of education from the viewpoint of graduated nurses working in Birjand hospitals, 2012. *modern care j.* 2014; 11 (3) :196-202. [Persian]
- Abedini, S Abedini, T Aghamolaei, A Jomehzadeh, A Kamjoo, The effect of different methods of health education on knowledge, attitudes and practice of female students regarding menstrual hygiene in Bandar Abbas. *Hormozgan Medical Journal* 2009; 12 (4) :271-279. [Persian]
- Damavandi M.E, Shekari Kashani Z. Effect of mastery learning method on performance and attitude of the weak students in chemistry .*Procedia Social and Behavioral Sciences* 5 (2010); 1574–1579.
- Shafie N, Norainun T, Shahdanb T, Liewc M.S. Mastery Learning Assessment Model (MLAM) in Teaching and Learning Mathematics. *Procedia Social and Behavioral Sciences.* 2010 ; 294–298.
- Haghani F, Masoomi R. Overview of learning theories and its applications in medical education. *Iranian Journal of Medical Education.* 2011; 10 (5) :1188-1197. [Persian]
- Bohrangi MR. *New patterns of teaching.* 8th ed. Golchine. Pub; 2006. [Persian]
- Seif A. *Assessment of learning processes and products (Old and New methods).* 1th ed. Agah Pub; 2010. [Persian]
- Ozden M. Improving Science and Technology Education Achievement Using Mastery Learning Model. *World Applied Sciences Journal.*2008; 5 (1): 62-67.
- Fasihharandi T, Soltaniarabshahi SK, Tahami SA, Mohammadalizadeh S. Viewpoints of medical students about the quality of clinical education. *The journal of Qazvin Univ. of Med. Sci.* 2004; 30: 4-9. [Persian].
- Anbari Z, Ramezani M. The obstacles of clinical education and strategies for the improvement of quality of education at Arak University of Medical Sciences in 2008. *AMUJ* 2010; 13(2): 110-118. [Persian]
- Baghaei R, Mohammadpour Y, Habibzade H, Rasouli D, Khalilzadeh H, Jafarizadeh H. Competency- Based Mastery Learning: A Planned clinical experience for nursing students . *Journal of Nursing and Midwifery Urmia University of Medical Science.* 2011;9(4): 230 – 236. [Persian]
- McGaghie WC, Fisichella PM. The science of learning and medical education. *Med Educ.*2014; 48(2): 106-8.
- Shekari Kashani Z, Damavandi ME, Karami Gezafi A. The effect of learning and mastery on attitude , performance and intrinsic motivation of female students in learning chemistry concepts. *Novine Journal of Education* 2009; 6(2): 155-71. [Persian]
- Siadati A, Karbaschi K. The clinical training effect on the recognition, attitude and mastery of nursing students' clinical skills at Islamic Azad University, Varamin Branch. *Journal of Health Breez.*2012; 1(1): 25-30. [Persian]
- Rahmani A, Mohajjel Aghdam A.R, Fathi Azar E, Roshangar F . Comparison the effect of two clinical teaching models on performance of nursing students in intensive care unit. *IJNMR* 2008; 13(2): 81-86.
- Sutton Roberts D, Ingram RR, Flack SA, Jones Hayes R. Implementation of mastery learning in nursing education. *J Nurs Educ.* 2013 ;52(4):234-7.
- Norози H, mohsenizadeh S, jafary suny H, ebrahimzadeh S. The Effect of Teaching Using a Blend of Collaborative and Mastery of Learning Models, on Learning of Vital Signs: An Experiment on Nursing and Operation Room Students of Mashhad University of Medical Sciences. *Iranian Journal of Medical Education.* 2011; 11 (5) :544-553. [Persian]
- Guskey, T. R. Closing the achievement gap: Revisiting Benjamin S. Bloom's "learning for mastery." *Journal of Advanced Academics.* 2007; 19: 8–31.
- Wambugu PW, Changeiywo JM. Effects of Mastery Learning Approach on Secondary School Students' Physics Achievement. *Eurasia Journal of Mathematics, Science & Technology Education,* 2008; 4(3): 293-302.
- Wayne DB, Butter J, Siddall VJ, Fudala MJ, Wade LD, Feinglass J, McGaghie WC .Mastery Learning of Advanced Cardiac Life Support Skills by Internal Medicine Residents Using Simulation Technology and Deliberate Practice. *J Gen Intern Med.* 2006;21(3):251-6.
- Rahmani A, Mohajjelaghdam A, Fathiazar E, Roshangar F. The Effect of Adapted Model of Mastery Learning on Cognitive and Practical Learning of Nursing Students *Iranian Journal of Medical Education,* 2008; 7 (2) :267-277 [Persian]
- Barsuk JH, Cohen ER, Caprio T, McGaghie WC, Simuni T, Wayne DB. Simulation-based education with mastery learning improves residents' lumbar puncture skills. *Neurology.* 2012;79(2):132-7.
- Patow CA. Medical simulation makes medical education better and safer. *Health Manag Technol.* 2005 ;26(12): 39-40.
- Barsuk JH1, Ahya SN, Cohen ER, McGaghie WC, Wayne DB. Mastery learning of temporary hemodialysis catheter insertion by nephrology fellows using simulation technology and deliberate practice. *Am J Kidney Dis.* 2009;54(1):70-76.
- Wayne DB, Butter J, Siddall VJ, Fudala MJ, Wade LD, Feinglass J, McGaghie WC. Making July safer: simulation-based mastery learning during intern boot cAMP. *Acad Med.* 2013 Feb;88(2):233-9
- Barsuk JH, Cohen ER, Caprio T, McGaghie WC, Simuni T, Wayne DB. Simulation-based education with mastery learning improves residents' lumbar puncture skills. *Neurology* 2012;79(2):132-7.
- Barsuk JH, Cohen ER, McGaghie WC, Wayne DB. Long-Term Retention of Central Venous Catheter Insertion Skills After

- Simulation-Based Mastery Learning. *Acad Med.* 2010;85(10 Suppl):S9-12.
28. Mohd Hasril A, Fathin Liyana Z. The Effects of a Mastery Learning Strategy on Knowledge Acquisition Among Aboriginal Students: An Experimental Approach. *International Journal of Vocational Education and Training Research.* 2015; 1(2): 22-26.
29. Seif A. *Educational psychology.* 13th ed. Agah Pub; 2005. [Persian]
30. Gentile JR. Assessing fundamentals in every course through mastery learning. *New Directions for Teaching and Learning;* 2004(100): 15-20.
31. Jain S , Nasrin N. Improving Student Achievement through Mastery Learning. Sunanda Jain and Nasrin. *Asian Journal of Multidisciplinary Studies,* 3(4) April, 2015
32. Guey C-c, Cheng Y-y, Shibata S. A triarchal instruction model: integration of principles from Behaviorism, Cognitivism, and Humanism. *Procedia - Social and Behavioral Sciences.* 2010;9:105-118.
33. Guey C-c, Cheng Y-y, Shibata S. A triarchal instruction model: integration of principles from Behaviorism, Cognitivism, and Humanism. *Procedia - Social and Behavioral Sciences.* 2010;9:105-118.
34. ShafeiPour Motlaq F, Yarmohammadian MA. A Model to Evaluate Factors Influencing Perceived Responsive Curriculum in Smart Schools. *Research in Curriculum Planning* 2011; 2 (28 and 29) :72-83.[Persian]
35. Kazu I Y, Kazu H, Ozdemir O. The Effects of Mastery Learning Model on the Success of the Students Who Attended "Usage of Basic Information Technologies" Course. *Educational Technology & Society* 2005, 8 (4), 233-243.
36. Cook DA, Brydges R, Zendejas B, Hamstra SJ, Hatala R. Mastery learning for health professionals using technology-enhanced simulation: a systematic review and meta-analysis. *Acad Med.* 2013; 88(8): 1178-86.