Smart Learning Environments

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Effects of quantum-learning and conventional teaching methods on learning achievement, motivation to learn, and retention among nursing students during critical care nursing education

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Abstract

Introduction: Nursing education needs to be dedicated to sparking creativity as well as enhancing dynamic thinking and clinical decision-making skills. In this respect, exploiting quantum-learning methodology can be effective since it provides contexts and contents to improve.

Objective: The main objective of this study was to compare the effects of the quantum-learning methodology and conventional teaching learning achievement, motivation to learn, and retention among nursing students during critical care nursing education.

Methods: This quasi-experimental study was conducted on 46 nursing students, enrolled in the sixth semester at the School of Nursing and Midwifery affiliated to Mashhad University of Medical Sciences, Mashhad, Iran, were initially randomized into intervention and control groups. Then, the phases of "enroll, experience, label, demonstrate, review, and celebrate model were implemented in the intervention group, receiving the quantum-learning methodology. With regard to the control group, education was fulfilled according to the conventional teaching method. The learning achievement was subsequently measured in each group using. One month later, the in both groups were calculated. The data collection tools included a demographic characteristics form and the Kolb's Learning Style Inventory and Learning Motivation Questionnaire. The data were finally compared via statistical tests.

Results: The total scores of the learning achievement in the intervention group were 16.84 ± 2.28 and these values were equal to 15.16 ± 2.41 in the control group, which were significantly different based on the independent-samples t-test results ($p < 0.001$). The retention mean scores in the intervention and control groups were also by 13.25 ± 1.88 and 11.71 ± 2.05, respectively ($p < 0.001$). In the intervention group, motivation to learn before and after education significantly different ($p < 0.001$). However,

such a significant difference was not observed in the control group before and after the intervention ($p = 0.30$).

Conclusion: It was concluded that teaching methods encouraging students and providing interactive and fun environments could boost motivation to learn and give rise to retention, particularly in skill-based programs and courses. Teachers can thus utilize dynamic models such as the quantum-learning methodology to help students understand and gain more nursing skills.

Keywords: Quantum-learning methodology, Conventional teaching method, Learning achievement, Motivation to learn, Retention, Nursing student

Introduction

In today's world, nurses are often required to develop special skills in terms of dynamic thinking or clinical decision-making for example ECG interpretation and early detection of dysrhythmia. There is also a need to pay much more attention to teaching methods for different programs and courses, beyond that ever-expected (Shirazi & Heidari, 2019). Teaching methods can thus play very significant roles in motivational beliefs and consequently help develop deep thinking and learning (August-Brady, 2005). Nurse educators facilitate student learning in complex clinical environments. Given limited time in clinical, new methods to enhance and extend learning are needed (Heid, 2015). Research on nursing and midwifery teaching methods suggest that motivational beliefs, the way learning process occurs, as well as approaches and strategies for self-regulated learning have been thus far less considered among nursing and midwifery students (August-Brady, 2005). Inability to study and remember teaching materials can accordingly cause too much stress among these individuals. Superficial learning can even influence student performance levels in terms of dealing with patients and lead to their dissatisfaction (Afrasiabifar et al., 2014a, 2014b; Bakhshi et al., 2018). Selecting an appropriate teaching method is accordingly one of the most important educational principles that can significantly contribute to teaching–learning process. Deciding on teaching methods can also affect the learning achievement among nursing students. Knowledge of these methods and assortment of the best one can thus result in the maximum use of opportunities and improved quality of education (Karimi Monaghi, 2013; Lamiri et al., 2020; Mehdain et al., 2002; Mohammadi et al., 2015; Ranjbar et al., 2003). Therefore, teachers can apply a variety of teaching–learning models and help students in learning and retention of various materials (Harden & Crosby, 2000; Shabani, 1995). Timely use of appropriate teaching methods can thus produce self-actualization in students and empower them in terms of learning (Golafrooz Sgahri & Khaghanizade, 2010; Karimi Monaghi, 2013).

There are two general approaches for educational programs, i.e., teacher-centered and student-centered. In the teacher-centered approach, the main objective is to shape behaviors based on a predetermined model, wherein teachers play the central and essential roles (Afrasiabifar et al., 2014). Transferring the data directly to students is accordingly performed with the stipulated materials and contents presented through lectures by which a complete set of facts, concepts, and principles can be taught in a coherent manner to students, but overall they receive the prepared

materials and are not active in terms of discovering facts (Ranjbar et al., 2003). Therefore, lecture-based learning method is an appropriate channel for providing basic information and transferring experimental sciences, as the most effective teaching method in some cases. Although this method is easy-to-implement and cost-effective with a long history in education systems, it has some drawbacks such as low flexibility, inactivity, rapid forgetting of materials, fatigue, high rate of absenteeism, and no motivation (Afrasiabifar et al., 2014a, 2014b). The use of this teaching method alone can thus lead to low quality of learning among students (Mohammadi et al., 2015).

The second approach is student-centered, in which learning is built on the social-cognitive theory (SCT) and constructivism, wherein students are directly involved in learning process. Besides, student-centered teaching can accelerate learning, create problem-solving skills, and maintain learning and critical thinking (Ali, 2019). One of the student-centered models is the quantum-learning methodology (QLM) that makes it possible to exercise a combination of learning theories in a fast, integrated, and effective manner in classrooms (Bahaddin & Yusuf, 2015). This method can be thus much more effective by providing contexts and contents to improve teaching–learning process and making training more interactive and fun (Dong et al., 2008). Among the distinctive features of the QLM is the focus on a lively environment for students. Here, learning contexts are assumed as living systems. The learning environment in the QLM, unlike traditional instruction, is thus comprised of an organic, dynamic, and interrelated continuum of relationships, wherein students are continually learning, adapting, and changing (Sari & Jusar, 2018). The QLM also concentrates on four important factors for motivation to learn including location, environment, external stimulus, as well as objective and means to achieve it (Fayanto et al., 2019). Motivation is thus a powerful force in teaching–learning process, so that even the richest and the best-organized internship and training programs fail in case of lack of students' motivation (Amini et al., 2002).

Educators are expected to develop interesting base of change's environment, student-centered learning activities. Educators should be aware that learning can improve psychomotor abilities and affective. Educators should also make it possible for students to be creative, be able to express opinions, be able to answer questions, and can work together to achieve goals (Sujatmika et al., 2018). Quantum learning is a form of learning activity that is in an environment that makes happiness (Suryani & Drajati, 2021). Therefore, the QLM is an attempt by teachers to coordinate different moments of learning, so that skills and natural talents in students can become more brilliant. It's a benefit of QLM, Accelerated learning is also considered as a component of the QLM that to create an active learning atmosphere through student centered approach one of the methods is the accelerated learning method (Suryani & Drajati, 2021). The use of music, colorful environments, as well as appropriate materials and contents can thus lead to active involvement of students in teaching–learning process (Suryani, 2013).

Numerous studies have so far reflected on the effectiveness of the QLM. For example, Porter stated that the implementation of this method would bring about an increase in motivation, scores, self-confidence, self-esteem, as well as skills by 68%, 73%, 81%, 84%, and 98%, respectively (Janzen et al., 2012). Kolb's Learning Style model is a combination of experience, cognition, perception, and behavior. There are four categories of learning modes or orientations in the model which are abstract conceptualization (AC), concrete

experience (CE), active experimentation (AE) and reflective observation (RO) (Patil et al., 2018). These types of people are objective, patient, and suited in a various sartistic field such as nursing (Altun, 2019).

In line with the mission of the medical education system that is fostering creative and critical thinking in individuals, it is of utmost importance to elucidate the best and the most effective teaching methods for clinical learning among students of medical sciences. The experience of the research team as a nursing teacher in learning skills such as electrocardiogram (EKG) interpretation. Teaching skills using the lecture method is not enough to learn. Using student-centered techniques based on changing the learning environment can help motivate and learn skills Therefore, selecting an effective teaching method for sustainable learning in students can play a significant role in the future of their clinical practices.

Research objectives

Accordingly, to calculate the usability of the system following research questions are addressed.

RQ1 To determine of teaching by quantum learning method with conventional teaching method on students' learning motivation.

RQ2 To determine of teaching by quantum learning method with conventional teaching method on students' memorization.

Methodology

Study design

In this quasi-experimental study, the two methods of teaching Quantum-Learning Method and lecture were compared. After obtaining the approval for the present study with the code number: IR.MUMS.NURSE.REC.1397.010 from the Medical Ethics Committee of Mashhad University of Medical Sciences and making the necessary coordination, the sampling was commenced by submitting a letter of introduction from the Vice Chancellor's Office for Research to the Vice Chancellor's Office for Education at the School of Nursing and Midwifery affiliated to Mashhad University of Medical Sciences, Mashhad, Iran.

Sample of study

In this study, population consisted of all nursing students, selected using the census sampling method, enrolled in the sixth semester at the School of Nursing and Midwifery affiliated, in the academic year 2020–2021. Sampling was performed by that included all the students available in that population. Of note, these individuals were taking the coronary care nursing education courses. Upon preparing the list of the students, they were numbered and then divided into intervention and control groups based on the random number table. As a whole, two students did not attend the classrooms and excluded from the study. Two other cases were also removed due to no participation in one intervention session. At the end, 21 students remained in each study group. The study findings

showed that 52.4% of the samples in both groups were female and 47.6% of them were male. The bulk of the individuals in the two groups were unmarried.

Method and data collection

Before starting education for both groups, in a meeting attended by all students, the researcher introduced herself, delineated the research objectives, and then obtained an informed consent from the students to participate in this project. The LSI was then administered. According to the educational contents and lesson plans prepared in cooperation with the supervisor and the teacher of the coronary care nursing education course as well as different sources and references acknowledged by the Ministry of Health and Medical Education, the coronary care nursing education course particularly the contents about the electrocardiography (ECG) interpretation were presented to the control group employing the conventional teaching method along with the use of a whiteboard and the Microsoft PowerPoint by the researcher during two sessions of 90 min. At the beginning of each session, the lesson plan was provided to the students. In the first session, the educational goals and the contents on the electrical activities of the heart and its derivatives were presented in the form of lectures together with questions and answers. The second session was also completed 1 week later, wherein the determination of the ECG waves, axes, and rates were presented through lectures as well as questions and answers. At the end of the sessions, the educational contents were provided to the students.

As attention to students' learning styles is a feature of the QLM, the intervention-group students' learning styles were determined using the LSI prior to education. The teaching method was further concluded according to the students' learning styles. 57.1% of the students in the experimental group had the learning style of abstract conceptualization. The classroom was thus designed in accordance with the principles of using the QLM before education. To design the classroom and to create vitality, right layout and regular chairs as well as use of flowers and educational posters were considered.

Accordingly, 10 educational posters related to the contents were prepared in the first session and installed in the classroom. In the second session, eight new educational posters associated with new topics and two posters from the previous session were installed to remind the previous contents. Educational posters were designed based on the content of the class. The content of the posters includes the steps of interpreting the ECG, training to determine the axes of the heart and cardiac dysrhythmias. Posters and banners were posted on the classroom wall. As well, four motivating quantum-learning posters were cooperatively prepared and installed for students in both sessions. As the use of instrumental music during the QLM is assumed as one of the features of this model, this type of music was exploited from the beginning of the classroom. The selection of the type of music was done in conformity with the culturally relevant styles and with reference to the studies on the effect of music on educational programs and courses. Accordingly, traditional instrumental music, Mozart's piano music performance, as well as music files provided at the Quantum Center website were utilized during teaching.

The phases of the implementation of the QLM were such that at the beginning of each session, the students were given a lesson plan. Then, the education was completed in two 90-min sessions for students according to the six phases of "enroll, experience, label,

demonstrate, review, and celebrate (EEL DR. C)" model. The enroll process started with the arrival of students to classrooms. After introducing herself, the teacher greeted the students and talked to them about topics such as their motivation for studying nursing, educational goals, as well as objectives of learning about the coronary care nursing education course, and accordingly paved the grounds to start the classroom.

The experience phase was also implemented using the experiences of students about heart diseases and the importance of paying attention to patients with such problems and the significance of learning about ECG interpretation with clinical examples given by the students. The label phase also included learning about the new abstract concepts employing different tools. In this phase, the contents were focused on the electrical activities of the heart and its derivatives, as well as the determination of the ECG waves, axes, and rates, presented by the researcher via the Microsoft PowerPoint, instructional videos, and group discussions and according to the educational posters. Besides, the demonstration phase included expressing the part of the contents taught by teachers and students. In this phase, opportunities were provided to students to show what they knew. Accordingly, panels and in-group problem-solving sessions were considered. The next phase reflected on reviewing the taught materials and their contents. In this phase, the students reviewed and counted the new learned materials by repeating them, and again, by referring to the educational posters, the contents were repeated briefly. At the end, in the celebration phase, the students were appreciated through giving gifts, music files were played, and all attendants gave a round of applause. At the end of the sessions, the educational contents were provided to the students. The students were then evaluated using a written test of the taught materials, which consisted of 16 multiple-choice items and 4 descriptive ones, designed by the researcher with the help of the supervisors. One month later, the retention test was taken from the students in two groups with no prior coordination.

Tools

Quantitative tools

The data collection tools also included a demographic characteristics information form include age, sex, Grade point average, exam rank, Interest in the field. The Kolb's Learning Style Inventory (LSI) and Learning Motivation Questionnaire. The Kolb's Learning Style Inventory questionnaire consists of 12 items and four options are suggested for each item. Subject, Rates the answer from 1 to 4 depending on how you learn. In this way, in each item, the option that most closely matches the student's learning style is assigned a score of 4. Score 3 on an option that is moderately in line with the student's learning style. Score 2 on an option that poorly matches the student's learning style. An option that does not match the student's learning style is given a score of 1In this line, Kolb et al. had measured the reliability of the LSI using the Cronbach's alpha coefficient and the Spearman-Brown prophecy formula. The reliability coefficients of the questionnaire constructs, including concrete learning, reflective observation, abstract conceptualization, and active experimentation were equal to 0.65, 0.64, 0.67, and 0.74, which confirmed the favorable reliability of this inventory (Kolb, 1985). The validity of the LSI had been further established in a study by Reynolds et al., (2020). To assess the reliability of the given questionnaire in this study, Cronbach's alpha coefficient was employed in

which the values of student character, teacher performance, peer influence, family support/involvement, and learning facilities were equal to 0.76, 0.80, 0.71, 0.70, and 0.70, respectively.

Learning Motivation Questionnaire: This questionnaire consists of 26 questions that are graded and graded with very high, high, medium, low, and very low. Score between 26 and 43: Learning motivation is low. Score between 43 and 86: Learning motivation is moderate. Score above 86: The level of motivation to learn is high. In this study, Cronbach's alpha methods were used to assess the reliability of the Learning Motivation Questionnaire (0.88) (El-Adl & Alkharusi, 2020).

Learning achievement test: Questions were prepared based on the objectives, content of the lesson and in accordance with the lesson plan. The intervention consisted of 16 test questions and 4 descriptive questions. Memorization exam: Questions were prepared based on the objectives, content of the lesson and in accordance with the lesson plan. The intervention consisted of 18 test questions and 2 descriptive questions.

Data analysis

The statistical analysis was done using the SPSS Statistics software (ver. 16). The Kolmogorov–Smirnov normality test, the independent-samples t-test, the Mann–Whitney U test, the Chi-square test, and the Fisher's exact test were also employed. Data analysis was ultimately done at a significance level of 0.95.

Results and findings

Both groups were also homogenous in terms of the variables of age, grade point average (GPA), the Iranian University Entrance exam admission rank, and interest in their field of study (Table 1).

The total scores of learning achievement in the intervention group were 16.84 ± 2.28 and these values were equal to 15.16 ± 2.41 in the control group. The independent-samples t-test results also showed a significant difference ($p < 0.045$) in the achievement of learning mean scores in both groups. The retention mean scores in the intervention and control groups were also equal to 13.25 ± 1.88 and 11.71 ± 2.05, respectively ($p = 0.005$), which were significant according the independent-samples t-test results (Table 2). The total score of motivation to learn before education in the control group was 93.55 ± 21.92 and that was 99.22 ± 13.18 in the intervention group. The given values after education were 105.35 ± 12.00 and 107.95 ± 11.35 in the intervention and control groups, respectively. The independent t-test also demonstrated no significant difference

Table 1 Demographic characteristics in two groups of intervention and control

Variables	Intervention group Mean ± SD	Control groups Mean ± SD	*p*
Age	22.09 ± .995	23.90 ± 4.71	.541*
grade point average	18.33 ± 1.75	18.09 ± 1.13	.864*
the Iranian University Entrance exam admission rank	10,192.5 ± 3062.42	6377.61 ± 4076.5	.800*
interest in their field of study	6.65 ± 2.6	6.09 ± 2.46	.329*

*Mann–Whitney U

Table 2 Comparison of learning rate scores in intervention and control groups

Variables	Intervention group Mean ± SD	Control groups Mean ± SD	*p*
The total scores of rate of learning	16.84 ± 2.28	15.16 ± 2.41	.045*
The retention mean scores	13.25 ± 1.88	11.71 ± 2.05	.005*

*The independent-samples t-test

Table 3 Comparison of total motivational learning scores in the intervention and control groups before and after the intervention

Variables	Intervention group Mean ± SD	Control groups Mean ± SD	*p*
The total score of motivation to learn	99.22 ± 13.18	93.55 ± 21.92	.953*
The retention mean scores	107.95 ± 11.35	105.35 ± 12.00	.480*

*The independent-samples t-test

($p = 0.480$). In the control group, motivation to learn before and after education was not significantly different ($p > 0.030$) according to the paired-samples t-test results. However, such a significant difference was observed in the intervention group before and after the intervention with reference to the paired-samples t-test results ($p = 0.010$) (Table 3).

Discussion

Comparing the effects of the QLM and conventional teaching method on nursing students' achievement of learning in the coronary care nursing education course revealed that the mean scores of students in the intervention group had significantly increased than those in the control group. The average retention in the students in the intervention group, 1 month after education, also enhanced in a significant manner, compared with those in the control group. The mean scores of students' motivation to learn in the intervention group were not significantly different from those in the control group, but a significant difference was observed in the motivation to learn scores before and after training in the intervention group.

The QLM is thus known as a process of learning, providing contexts and contents to improve teaching–learning process and to make education more interactive and fun (Bahaddin & Yusuf, 2015). The use of dynamic learning methodology such as the QLM with an emphasis on motivation-building is thus part of the information imported into the short-term memory that is connected to the information learned previously and transfers the data to the long-term memory in an organized manner, which can be effective in the long run (Setiawan & Indriwati, 2018). In line with the present study, Suryani (2013) in their research on enhancing students' learning skills through the QLM in Indonesia had found that the quantum-based approach had given rise to better competence in students compared with those receiving an interpretive approach (Suryani, 2013). Abdulla (2012), in their study on tenth-grade students, aimed to teach reading using the QLM, had further reported that the students' scores had increased by 85%, which were consistent with the findings of the present research (Abdullah, 2012). Moreover,

Bahaddin & Yusuf (2015) in their study, determining the impact of the QLM on students' success and stability of their attitudes towards science in Turkey, had demonstrated that the learning-quantum approach could have positive effects on academic achievement, levels of satisfaction, and attitudes among students (Bahaddin & Yusuf, 2015). Given that one of the distinctive features of the QLM is laying more focus on inspirational environments for students (Janzen et al., 2012), active involvement in dynamic learning environments alive with energy can encourage learning process and lead to better learning among them.

Motivation is thus a powerful force in teaching–learning process, so that even the richest and the best-organized internship and training programs fail to be useful in the absence of motivation in learners (Khavid et al., 2020). The results of the present study showed that the use of the QLM could boost motivation in learning. The findings were also in agreement with the results of the study by Dadgaran & Khalkhali (2015) in which the impact of the QLM on medical students learning biochemistry courses had been investigated. Participating in a quantum-based teaching–learning program can be accordingly effective in the variables of academic motivation and achievement (Dadgaran & Khalkhali, 2015). Therefore, motivation is deemed as an important factor in learning process among students.

Conclusion

The study results demonstrated that the use of the QLM, which is based on creating a learning environment replete with joy, vitality, and dynamism, could augment learning process, motivation to learn, and retention among students. Thus, the given model can be practiced as a new method of learning in educational systems. Based on these results, teachers of nursing are suggested to become more familiarized with the QLM, and then exploit it to teach different courses, particularly skill-based ones. Teachers and educational planners in medicine can thus make the best use of this method to help students become more active in learning and seek for desire and interest to complete their professional knowledge. Timely use of appropriate teaching methods and models can also lead to self-actualization and empower students to learn. Creating a dynamic environment for students using the QLM can accordingly produce better learning and boost motivation. A combination of motivation and better learning can consequently result in more and longer retention.

Abbreviations

QLM: Quantum-learning methodology; LSI: Kolb's Learning Style Inventory; SCT: The social-cognitive theory; ECG: Electrocardiography; GPA: Grade point average.

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Authors' contributions

SAK, NVZ, HKM, contributed to the literature review collection, methodology design, and reliability, and interpretation of the data. TS contributed to the data collection, data analysis and results procedure and the preparation of the manuscript. MMT contributed to the data collection. The submitted manuscript is approved by all authors. Five authors collaborated in writing, reading, and approving the manuscript.

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Availability of data and materials
The data of current study are freely and openly available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study protocol and study methodology was approved by ethic committees in Iran (Mashhad University of Medical Sciences IR.MUMS.NURSE.REC.1397.010). All participants gave a written informed consent.

Competing interests
There are competing interests with any authors or organization.

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