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Comparing game-based and traditional testing in emergency nursing education: effects on self-directed learning and academic confidence

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No longer recruiting

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Completed

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[_] Results
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Plain English summary of protocol
Not provided at time of registration

Contact information

Type(s)
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Study information

Scientific Title
A multi-phase ADDIE-based study in emergency nursing education: comparing the effects of Kahoot-based and traditional assessment on self-directed learning and academic self-efficacy

Study objectives

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 12/01/2025, Ethics Committee of Abadan University of Medical Sciences (Abadan University of Medical Sciences, Abadan, 6319811916, Iran; +98 (0)9853384004; Info@abadanums.ac.ir), ref: IR.ABADANUMS.REC.1403.151

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Active

Assignment
Parallel

Purpose
Basic science

Study type(s)

Health condition(s) or problem(s) studied
Emergency nursing education focusing on crash cart medication and emergency management for undergraduate nursing students

Interventions
This study employed a two-group quasi-experimental pretest–posttest design embedded within a multi-phase educational development study. This study adheres to the Consolidated Standards of Reporting Trials (CONSORT) guidelines to ensure transparency and comprehensive reporting of the randomized controlled trial design and methodology.

The overall framework followed the ADDIE instructional model (Analysis, Design, Development, Implementation, and Evaluation). The primary comparative component of the study examined the effects of two assessment methods (Kahoot-based digital assessment and traditional paper-based assessment) on academic self-efficacy and self-directed learning among undergraduate nursing students. Baseline and post-intervention measurements were obtained for both groups to evaluate changes over time and differences between assessment methods. The preceding phases, including needs assessment, course development, and simulation-based training, provided the educational foundation for the intervention and ensured content validity. These phases were not considered independent studies but rather sequential and interrelated components of a comprehensive instructional development process. The multi-phase structure was necessary because the educational intervention was developed based on identified clinical and educational needs and subsequently evaluated using a comparative assessment approach.

The initial needs assessment phase involved qualitative data collection through semi-structured interviews with nurses to identify gaps in knowledge and clinical performance in emergency care. The study was conducted in three tertiary hospitals in Abadan, Iran, which serve as major centers for emergency services. The methodological steps are as follows:

Development phase: assessment and needs analysis:
The development phase was conducted to identify gaps in nurses' knowledge and clinical competencies in emergency care. The aim of this phase was to comprehensively assess baseline clinical performance, CPR outcomes, and knowledge of emergency trolley medications to inform the development of an educational intervention. This phase included three complementary components: (1) direct observation of clinical performance, (2) retrospective evaluation of CPR outcomes, and (3) a cross-sectional assessment of nurses' knowledge of emergency trolley medications.

Clinical performance observation (observation phase):
Nurses' clinical competencies were systematically assessed in real clinical settings using direct observation with standardized checklists. This approach minimized recall bias and allowed objective evaluation of technical and non-technical skills in authentic patient-care environments.

This study utilized standardized checklists based on AHA (2020-2024) guidelines and JCI standards to evaluate nurses' technical, behavioural, and communication skills in clinical settings. The Clinical Performance Assessment Checklist measured competencies in patient safety, infection control, medication error prevention, equipment management, documentation, and ethics. The Emergency Cart Checklist assessed readiness, familiarity with emergency drugs, access to airway equipment, and performance under critical conditions. CPR skills were evaluated using the AHA 2020–2024 CPR Checklist, focusing on chest compressions, ventilation, airway management, defibrillator use, and appropriate timing (21). Additionally, the Professional and Communication Behavior Checklist evaluated patient communication, SBAR use (23), teamwork, stress management, and confidentiality. The Emergency Response Checklist assessed actions taken during critical moments, including ABC assessment and code team activation. Together, these tools provided a comprehensive framework for evaluating clinical and emergency response competencies. Scoring of performance checklists used a three-point scale (2 = correct and complete, 1 = incomplete or erroneous, 0 = not performed) to differentiate performance clearly. Multi-step items received a score of 2 only if all steps were correctly performed; any errors led to a score of 1. Checklist scores were converted to percentages for standardized comparison. Two independent evaluators assessed each observation, and their average score was recorded. If discrepancies exceeded 20%, the observation was reviewed for expert consensus on the final score. This method ensured reproducibility, accuracy, and minimal bias, providing a solid quantitative basis for analysis.

Registered nurses working in emergency departments, intensive care units (ICUs), coronary care units (CCUs), and resuscitation wards across three tertiary hospitals in Abadan, Iran, were included in the study. Inclusion criteria consisted of being a registered nurse with at least six months of clinical experience and working in the selected clinical units during the study period, while nurses on long-term leave or those who declined participation or did not complete the assessment were excluded. A census sampling approach was used in the observational phase, in which all eligible nurses present in the selected hospitals during the study period were included. To capture variability in workload and clinical exposure, nurses from morning, evening, and night shifts were assessed. Each participant was assigned a coded identifier to ensure anonymity, and evaluators were blinded to demographic and professional characteristics to minimize assessment bias. This approach enhanced the representativeness of the sample and improved the external validity of the findings by reflecting real-world nursing workforce conditions.

Data collection involved direct, real-time observation of nurses in their clinical environment without prior notice to minimize the Hawthorne effect and ensure naturalistic behavior. Two trained evaluators independently used standardized checklists to ensure objective assessment of performance. To enhance methodological rigor and reduce measurement bias, evaluators underwent structured training on scoring criteria, followed by pilot observations to establish inter-rater reliability. Multiple bias control strategies were implemented, including the use of objective standardized checklists to reduce subjective interpretation bias, blinding of evaluators to participants' demographic and professional characteristics to minimize observer bias, and independent dual assessment of each participant. Discrepancies between evaluators were resolved through expert consensus when differences exceeded predefined thresholds. Observations were conducted across different shifts and clinical settings to reduce selection and performance bias and to improve representativeness. The principal investigator performed a final audit of the data to ensure completeness and consistency, thereby enhancing internal validity and data integrity.

To evaluate cardiopulmonary resuscitation (CPR) performance and resuscitation outcomes, data from CPR events over a 3-year period were extracted from hospital incident reporting systems and patient medical records. Variables included causes of cardiac arrest, timing and type of interventions, and return of spontaneous circulation (ROSC) as the primary indicator of successful resuscitation. CPR performance was assessed in relation to American Heart Association (AHA) quality standards (21). Descriptive statistical analyses, including means and frequencies, were used to summarize the data, and inferential analyses were applied to examine associations between CPR outcomes and potential influencing factors such as delay in initiation of CPR and team performance.

A cross-sectional study was conducted to assess nurses' knowledge of emergency trolley medications as part of CPR competency evaluation. The study followed STROBE reporting guidelines. This phase focused on evaluating knowledge related to drug names, dosages, mechanisms of action, indications, adverse effects, and safety considerations in emergency care settings.

The primary data collection tool was a standardized written examination designed to assess nurses' knowledge of emergency trolley medications, including drug names, dosages, mechanisms of action, indications, adverse effects, and safety considerations. The items were developed based on the latest AHA guidelines and standard pharmacology references, including Katzung's Basic & Clinical Pharmacology. Content validity was assessed by a panel of two emergency medicine specialists and five PhD-prepared nursing experts using the Content Validity Index (CVI) and Content Validity Ratio (CVR), and items that did not meet the predefined validity thresholds were excluded.

The study population included nurses working in emergency departments, intensive care units (ICUs), coronary care units (CCUs), and resuscitation wards across three affiliated hospitals in Abadan, Iran. Inclusion criteria were registered nurses with at least six months of clinical experience in the selected clinical units, while exclusion criteria included nurses who were on extended leave during the study period, those who declined participation, or those who did not complete the assessment process. The total eligible population was approximately 400 nurses.

The study population included nurses working in emergency departments, intensive care units (ICUs), coronary care units (CCUs), and resuscitation wards across three affiliated hospitals in Abadan, Iran. The total eligible population was approximately 400 nurses. The sample size was determined using Cochran's formula for finite populations. The initial sample size was estimated

based on a 95% confidence level (Z = 1.96) with assumed proportions of 0.40, 0.50, and 0.60 to ensure a conservative estimate and a margin of error of 0.05. The initial sample size was then adjusted using the finite population correction method to account for the limited population size. This adjustment resulted in an estimated sample size of approximately 205 participants. To compensate for potential non-response or incomplete questionnaires, 10% was added to the final sample size, resulting in a total of 226 nurses. Sampling was conducted using a stratified random sampling method based on hospital affiliation, clinical unit, and years of experience to ensure proportional representation across all strata.

Participants were informed about the objectives of the study and provided written informed consent prior to participation. The written examination was administered under standardized conditions and in an anonymous format to minimize response and social desirability bias. Uniform testing procedures were applied to all participants to ensure consistency. Scores were calculated based on the number of correct responses and expressed as percentages. Data were analyzed using appropriate statistical software with descriptive and inferential statistical methods.

Following the development phase, which included assessment and needs analysis, the educational intervention was systematically designed and implemented. The aim of this phase was to develop a structured, competency-based training program that addresses identified gaps in emergency nursing knowledge, clinical skills, teamwork, and decision-making, and to evaluate its effectiveness through simulation-based learning.

The course was designed using a structured, needs-based and competency-orientated approach. The design process was informed by the results of the development phase, including observed gaps in clinical performance, CPR outcomes, and knowledge of emergency trolley medications. These findings were mapped to essential emergency nursing competencies to define targeted learning outcomes. A blended-learning curriculum was then developed in alignment with international standards and AHA resuscitation guidelines. The instructional design followed SMART criteria to ensure that all learning objectives were specific, measurable, achievable, relevant, and time-bound. The theoretical content was structured to cover crash cart pharmacology, mechanisms of action of emergency medications, dosing protocols, safety considerations, ABC-based rapid patient assessment, crisis management principles, and SBAR communication techniques. The practical component was designed based on simulation-based learning principles, focusing on experiential training in rapid patient assessment, crash cart organization, medication preparation during resuscitation, and active participation in code team scenarios. To support clinical reasoning and decision-making, the instructional strategy integrated interactive lectures, case-based discussions, and algorithm-driven learning activities. Structured communication skills were reinforced through repeated use of the SBAR framework during simulated emergency scenarios. Educational materials included validated instructional videos, crash-cart pharmacology handbooks, resuscitation algorithms, and standardized performance checklists, all aligned with AHA guidelines, emergency.

The educational program was delivered by a multidisciplinary team consisting of nursing faculty members, emergency medicine specialists, and an advanced life support trainer. Participants were organized into small groups to facilitate active engagement, hands-on practice, and individualized feedback. The training sessions included timed skill stations, high-fidelity simulation scenarios based on AHA protocols, role-playing exercises, and structured debriefing sessions to reinforce clinical reasoning and teamwork. Standardized checklists were used to ensure consistency in performance assessment across all participants, and immediate feedback was provided to support skill acquisition and correction of errors. Participants also had access to supplementary learning resources, including OSCE checklists and instructional videos, to support

self-directed learning. Program outcomes were evaluated using Kirkpatrick's model, focusing on learner satisfaction, knowledge acquisition, behavioral change during early clinical exposure, and clinical outcomes, including CPR performance and return of spontaneous circulation (ROSC), assessed before and after the intervention.

The participants of this educational intervention were sixth-semester nursing students who had not yet completed their formal emergency nursing course and demonstrated comparable baseline academic performance. Inclusion criteria were enrollment in the sixth semester of the nursing program, willingness to participate, and absence of prior formal training in emergency nursing simulation courses. Students who declined participation or were unable to complete the full intervention and assessment process were excluded from the study. The required sample size was determined based on power analysis for comparing two independent groups. Assuming a moderate effect size ($d = 0.70$), a significance level of 0.05, and a statistical power of 80%, the minimum required sample size was estimated to be 52 participants. To account for potential attrition and missing data, the sample size was increased to 60 participants. A total of 60 eligible students were enrolled and allocated to two equal groups of 30 participants each. Participant recruitment and follow-up for this trial were conducted between February 2025 and May 2025. Participants were allocated into two comparable groups using stratified randomization based on age, gender, and academic performance (GPA) to ensure baseline equivalence between groups. Each group was further subdivided into smaller subgroups of six students to facilitate effective simulation-based training, enhance participation, and improve instructor-to-student interaction during hands-on sessions. This structure was used to optimize learning conditions and ensure standardized delivery of the intervention across all participants.

The random allocation sequence was generated by an independent researcher who was not involved in the intervention, outcome assessment, or data analysis. Enrollment of participants was conducted by a research assistant who was blinded to the allocation sequence. Group assignment was performed by the principal investigator using sequentially numbered, opaque, sealed envelopes. Allocation concealment was maintained until after the completion of the intervention and post-test assessments. Participants were not informed of their group allocation until after the post-test.

The evaluated course employed a multi-level assessment framework using both traditional evaluation methods and a Kahoot-based digital platform to compare their effects on learning outcomes. The aim of this phase was to evaluate and compare the effectiveness of two assessment modalities (traditional paper-based versus Kahoot-based digital assessment) on multiple domains of learning outcomes, including theoretical knowledge, practical skills, behavioral performance, and psychological constructs following the educational intervention. The evaluation framework was designed to assess theoretical knowledge, practical skills, behavioral performance, and psychological learning outcomes following the educational intervention. Theoretical knowledge was assessed using standardized pre- and post-tests administered through both paper-based examinations and Kahoot-based quizzes. These assessments covered key domains including cardiopulmonary resuscitation (CPR) protocols, crash-cart pharmacology, and rapid patient assessment. Practical skills were evaluated using an Objective Structured Clinical Examination (OSCE), in which trained evaluators assessed participants across multiple stations, including CPR performance and airway management, using standardized checklists. Behavioral performance in clinical settings was assessed through structured observational tools to evaluate the transfer of learning to real-world emergency situations. Psychological outcomes were assessed using two validated instruments administered before and after the intervention. Academic self-efficacy was measured using the Academic Self-Efficacy Scale developed by Owens and Farham (1988), a 32-item instrument rated on a five-point Likert scale assessing perceived competence, persistence, and goal achievement ability.

Self-directed learning was measured using the Self-Directed Learning Questionnaire developed by Fisher et al. (2001), a 29-item scale assessing self-management, self-monitoring, and motivation. Both instruments underwent a rigorous process of translation, back-translation, content validation, and reliability testing prior to implementation.

This phase of the study aimed to compare the effects of two assessment methods (Kahoot-based digital assessment and traditional paper-based assessment) on academic self-efficacy and self-directed learning among undergraduate nursing students following participation in the educational intervention. A total of 60 sixth-semester nursing students participated in this phase and were allocated into two groups (n = 30 per group) using simple random allocation. Both groups received the same educational intervention, including theoretical instruction, simulation-based training, and practical skill development activities. The only difference between groups was the mode of assessment used following the intervention. Prior to the educational intervention, all participants completed baseline assessments of academic self-efficacy and self-directed learning using validated questionnaires. Following completion of the educational program, students in the intervention group completed a Kahoot-based digital assessment, whereas students in the comparison group completed a traditional paper-based assessment. The content, number of items, scoring criteria, and level of difficulty were equivalent across both assessment formats, with the mode of delivery representing the sole experimental difference. Academic self-efficacy was measured using the Academic Self-Efficacy Scale developed by Owens and Froman (1988), a 32-item instrument scored on a five-point Likert scale that evaluates perceived academic competence, persistence, and goal achievement. Self-directed learning was assessed using the Self-Directed Learning Readiness Scale developed by Fisher et al. (2001), which evaluates self-management, self-monitoring, and learning motivation. Both instruments were administered at baseline and immediately after completion of the intervention and assessment phase. Within-group changes from pre-test to post-test were examined to evaluate improvement over time, while between-group comparisons were conducted to determine whether the assessment method influenced academic self-efficacy and self-directed learning outcomes. Statistical analyses were performed using appropriate parametric or non-parametric tests according to data distribution, with a significance level of $p < 0.05$.

Statistical analyses were performed using SPSS version 26. Prior to primary analysis, data were screened for missing values and univariate outliers using z-score criteria ($|z| > 3.29$). Normality of distribution was assessed using the Shapiro–Wilk test for each group and outcome variable. Results indicated that post-intervention scores for academic self-efficacy and self-directed learning in both groups were approximately normally distributed (Shapiro–Wilk $p > 0.05$). Homogeneity of variances was examined using Levene's test prior to independent-samples t-tests; no significant violations were detected (Levene's $p > 0.05$). Accordingly, parametric tests were used for all primary analyses. Had normality assumptions been violated, the Mann–Whitney U test and Wilcoxon signed-rank test would have been applied as non-parametric alternatives for between-group and within-group comparisons, respectively.

Effect sizes were calculated using Cohen’s d. For paired (within-group) comparisons, d was computed as the mean difference divided by the standard deviation of the difference scores. For independent (between-group) comparisons, the pooled standard deviation was used. According to Cohen’s (1988) conventions, effect sizes of 0.2, 0.5, and 0.8 are considered small, medium, and large, respectively. Values greater than 2.0 were interpreted as very large effects. Continuous variables are presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Within-group changes from pre-test to post-test were analyzed using paired-samples t-tests. Between-group comparisons of post-intervention scores were conducted using independent-samples t-tests. Baseline equivalence between groups was

examined prior to outcome comparisons. All statistical tests were two-tailed, and the significance level was set at $p < 0.05$. Given that multiple statistical comparisons were performed — including pre-test equivalence between groups (2 outcomes × 1 comparison), within-group pre-to-post changes (2 outcomes × 2 groups = 4 tests), and between-group post-intervention comparisons (2 outcomes × 1 comparison) — a Bonferroni correction was applied to control the familywise error rate. The adjusted significance threshold was set at $\alpha = 0.05 / 8 = 0.006$. All reported p-values remained statistically significant under this corrected threshold, supporting the robustness of the findings.

Intervention Type
Behavioural

Primary outcome(s)
1. Academic self-efficacy measured using Academic Self-Efficacy Scale at baseline (before the educational intervention) and immediately after completion of the intervention and assessment phase

Key secondary outcome(s)

Completion date
25/12/2025

Eligibility

Key inclusion criteria
1. Enrollment in the sixth semester of the undergraduate nursing program
2. No prior formal training in emergency nursing simulation courses
3. Willingness to participate
4. Comparable baseline academic performance (GPA)

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
18 Years

Upper age limit
55 Years

Sex
All

Total final enrolment
60

Key exclusion criteria

1. Declined participation (withdrawal of consent)
2. Inability to complete the full intervention and assessment process

Date of first enrolment
21/02/2025

Date of final enrolment
19/08/2025

Locations

Countries of recruitment
Iran

Sponsor information

Organisation
Abadan University of Medical Sciences

ROR
https://ror.org/033z8fr92

Funder(s)

Funder type

Funder Name
Abadan University of Medical Sciences

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available