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Portfolios and Assessment of Personal Protective Devices Course Learning

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Abstract

Introduction: Portfolio assessment is one of the new and most accurate assessment methods. The objective of this study was to examine the introduction of portfolios in the assessment of students' learning in a personal protective devices course.

Methods: This study was a semi-experimental study that was conducted using the curriculum of the Ministry of Health for occupational health students from the school of health in Mashhad from 2013-2015. A personal protective devices course was taught and assessed with a modified essay in group A, a portfolio and a modified essay in group B and some tasks and a modified essay in group C. Each group had 35 students. Data were analyzed by ANOVA for comparison of means between groups; in addition, odds ratios with confidence intervals were calculated.

Results: The total grades of students in the personal protective devices course were calculated, and in group A the mean score was 18.52 ± 2.68 , in group B it was 19.71 ± 0.36 and in group C it was 18.93 ± 1.0 ($P=0.035$). There were some differences between the three groups. Specific lessons, such as those on ear protectors, respiratory protector calculation and eye protectors were promoted, and the mean grades for these lessons were higher in group B, which used portfolio assessment.

Conclusion: According to the results, portfolio assessment might be useful for the evaluation of undergraduate students' learning in practical aspects of personal protective devices.

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Introduction

According to the literature on medical sciences education, assessment methods are important in this field. Teachers are advised on the use of new and accurate methods for this reason.

According to previous studies, portfolio assessment has been used during medical sciences courses^{1,2} specifically for the evaluation of practical chapters. These portfolios included research, statements, reports and promotional reports.^{3,4} Both electronic and paperless portfolios are used, depending on the availability of computers. Researchers have recommended that electronic portfolios were useful for students at the postgraduate level, but not for students at the undergraduate level.

For undergraduates, paper portfolios could help with better assessment and allow teachers to give better feedback for necessary changes in the learning process as soon as possible.

According to the curriculum, occupational health has both general and specific courses. One of the specific courses is personal protective devices.^{5,6}

According to scientific studies, portfolio assessment is one of the most important methods for the assessment of learning in medical sciences.^{7,8}

Some studies have been done on the use of portfolio for measuring educational objectives.^{9,10}

In one study the role of the portfolio method in the assessment of practice and skills was examined, and the authors encouraged the use of portfolios in assessing practice and performance.¹ Researchers demonstrated that the use of formative feedback in portfolios about the problem-based learning setting could be useful, but students need support from their teachers for modifying their practices. In one study, professors paid attention to the implementation of portfolio assessment to evaluate

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competence in dental students.¹¹

Some studies talked about the electronic portfolio as a way to encourage assessment.¹² Studies have been done on portfolios in nurses' education,¹³⁻¹⁵ dental students,¹⁶ medical students^{17,18} and others.¹⁹⁻²¹

Another study showed the positive effect of portfolio assessment on student learning in prenatal training for midwives.²²

Teachers have demonstrated the role of formative assessment on learning of students.²³ Other studies have examined new methods of assessment, such as the portfolio method.²⁴ Research has shown that portfolios can be used as a tool for assessment and professional development in graduate nursing education.²⁴ In some previous studies, the portfolio method was not used and assessed in undergraduate students, but in this study the author studied this objective.

In this study, the author tried to introduce the use of portfolios for assessment of undergraduate students' learning. The objective was to examine the introduction of portfolio assessment of undergraduate students' learning in a personal protective devices course.

Materials and Methods

Study design and setting

This study was performed as a semi-experimental study from 2013-2015 on occupational health students from the school of health in Mashhad.

Population of study

Each of the three groups included 35 students.

The author used the consensus method for all occupational health students. The sample is from three entrance years and the three groups were randomly allocated.

Inclusion and exclusion criteria

The inclusion criteria were the study of occupational health in the entrance years of 2013-2015 and exclusion criteria were studying another field or entering the university in other years.

Performance and materials

The course plan of the personal protective devices course was written according to curriculum. In personal protective devices chapters there were definitions of ear protection, ear protectors factor calculation (noise reduction rating), respiratory protection, respirators protection factor calculation, eye protectors, protective gloves, protective clothes, specific controls, other controls, presentation and practical.

The personal protective devices course was taught with lectures and PowerPoint presentations. In group A the teacher assessed the students using a modified essay at the end of the semester. In group B each student prepared a portfolio containing some materials, research and a presentation, and were also assessed using a modified essay at the end. In group C students completed example tasks for homework and completed a modified essay at the end.

Validity and reliability of tools

Tests for the three groups were at the same difficulty level, they had the same teacher and were prepared by related teachers' opinions from the same department for correction and validity. There was a pilot study with a correlation of 0.86 in a sample of occupational health students and Cronbach's alpha was used for assigning the reliability.

Statistical analysis

Data were analyzed by SPSS 16, means and standard deviation were calculated, and because of the normality, the data were tested with the Kolmogorov-Smirnov test. ANOVA was used for comparison of means between the three groups, $P < 0.05$ was considered significant and odds ratios with confidence intervals were calculated.

Ethics considerations

For research ethics consideration, the researcher got oral confirmation from participants and all participants were told that cumulative data would be used and the names of the students would be kept confidential. This was a scholarship study presented for the educational department office from educational research, school of health and approved with number 93/1978950.

Results

They were 35 students in each of the three groups. Out of 105 students total, 53 (50.47%) were men and 52 (49.53%) were women. The mean age was 20 ± 1.02 years old.

The mean total grade in the personal protective devices course in group A (essay only) was 18.52 ± 2.68 , in group B (portfolio assessment and essay) it was 19.71 ± 0.36 and in group (C) (tasks and essay) it was 18.93 ± 1.006 with $t = 3.532$ and $P = 0.035$, indicating significant differences. Specific lessons such as definitions, ear protectors, respiratory protection calculation and eye protectors were promoted and these lessons' mean grades were higher in group B.

Table 1 shows the comparison of grades in the personal protective devices course chapters between the three groups.

The risk of wrong answer was lower in group B, but higher in groups A and C.

Table 2 shows the odds ratios of wrong answers in the personal protective devices course chapters in three groups.

Discussion

According to the results, the total grades were the best with the use of portfolio assessment of students in a personal protective devices course, and the differences were statistically significant.

The grades of specific lessons such as definitions, ear protectors, respiratory protection calculation and eye protectors were higher and statistically significant with portfolio assessment.

Because the students had exercises on main and important practical chapters, such as respirators and hearing protectors, they had prepared a large amount of research and materials on hearing protectors and respirators in their portfolios during the educational semester. Students in

Table 1. The comparison of grades in the personal protective devices course chapters between the three groups. ($P<0.05$)

Number	Subject	Group(A) (n=35) $\mu\pm SD$	Group(B) (n=35) $\mu\pm SD$	Group(C) (n=35) $\mu\pm SD$	P value
1	Definitions	0.66±0.37	1.00±0	1.00±0	<0.001
2	Ear protector	0.97±0.08	1.00±0	1.00±0	0.048
3	Ear protector calculation	0.94±0.13	0.90±0.27	0.96±0.18	0.550
4	Respiratory protection	0.88±0.21	0.99±0.05	0.93±0.21	0.171
5	Respiratory protector calculation	0.75±0.30	1.00±0	0.91±0.23	0.002
6	glasses	1.00±0	1.00±0	0.79±0.39	0.004
7	gloves	0.94±0.106	0.90±0.25	0.83±0.27	0.253
8	clothes	0.94±0.23	0.96±0.20	0.98±0.09	0.771
9	Specific controls	0.97±0.11	0.88±0.33	1.00±0	0.100
10	others	1.00±0	0.96±0.20	1.00±0	0.404
11	presentation	-	5.00±0	4.50±0.36	<0.001
12	practical	5.00±0	5.00±0	5.00±0	-
13	total	18.52±2.68	19.71±0.36	18.93±1.006	0.035

Table 2. The odds ratio of wrong answers in the personal protective devices course chapters in three groups. ($P<0.05$)

Number	Wrong in the answer	Group(A) OR(CI)	Group(B) OR(CI)	Group(C) OR(CI)
1	Definitions	7.625(3.997-14.546)	1.694(1.375-2.089)	1.848(1.467-2.329)
2	Ear protector	4.313(2.807-6.626)	1.568(0.313-1.873)	1.683(1.385-2.045)
3	Ear protector calculation	1.575(0.581-4.272)	1.50(0.690-3.259)	1.292(1.046-1.865)
4	Respiratory protection	2.250(1.978-5.175)	0.328(0.051-2.108)	1.945(1.367-2.431)
5	Respiratory protector calculation	4.462(2.212-8.997)	1.758(0.405-2.199)	1.744(1.311-1.777)
6	glasses	1.391(1.194-1.622)	1.641(0.349-1.997)	3.048(2.146-4.327)
7	gloves	1.782(1.294-2.082)	0.684(0.299-1.565)	1.520(0.862-2.681)
8	clothes	1.333(0.255-6.959)	0.944(0.185-4.832)	1.840(1.165-4.271)
9	Specific controls	1.985(1.172-5.649)	2.284(0.179-4.425)	1.718(1.402-2.104)
10	others	1.346(1.173-1.545)	2.917(0.109-4.034)	1.667(1.377-2.018)
11	presentation	-	2.00(0.516-2.639)	5.952(3.132-11.314)
12	practical	-	-	-

group B had better presentations in the classes. According to the odds ratios, in group B the risk of giving the wrong answer in practical chapters was lower than in the other groups. Some theoretical chapters had more wrong answers in this group. The Health Ministry's curriculum could be helpful in teaching and assessing students' learning. Personal protective devices is one of the specific courses in the occupational health field.^{5,6} In this course, the teacher taught the definitions and types of personal protective devices, including information on hearing protectors, hearing protectors factor calculation or noise reduction rating, respirators, calculation of respirators protection factor, eye protectors, gloves, protective clothes, specific controls and other controls. The course had both theoretical and practical items that were necessary for learning. Some studies demonstrated the role of the portfolio in assessment of skills and found the same results regarding practical chapters assessment as the current study.¹ Another study showed that the use of formative feedback and portfolios in a problem-based learning setting could be self-regulated, but needed support.⁴ Specifically, it was found that teachers should assess the portfolios of undergraduate students (like those examined in this study)

and give them advice and recommendations. One study showed that the grading in a portfolio-based system for assessment of student performance and perspective, and this study demonstrated the applications of this assessment.⁸ Another study researched the implementation of portfolio assessment for students' competence in dental schools and it indicated portfolios had useful results.¹¹ Another study was performed about the use of portfolios as a tool for assessment and professional development in graduate nursing education.²⁴ In this study the researcher found the positive effect of portfolio on post graduated. Other studies worked on the portfolio for post graduated but there was no study on under graduate. Studies demonstrated the positive effects of this assessment method on better learning and assessing. Overall the portfolio method had an important effect on students' assessment and learning in courses, especially in practical courses. Because of the benefits of portfolio assessment during the semester, the researcher in this study tried to introduce and use portfolios for undergraduate students. The study was successful as the teachers' feedback for students during the semester using the portfolio method modified student

learning, especially in practical data and preparation for the final test.

This study had some limitations; the numbers of students within the three entrance years to the university were limited.

Another study is recommended with more students with the same entrance year. This study suggests that the portfolio method is useful for undergraduate students' assessment.

Conclusion

According to the results, portfolio might be useful for the assessment of undergraduate students' learning in practical chapters.

Competing interests

The author declares no conflict of interest.

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