

Research Article

Ergonomics and Assessment in Medical Sciences

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Abstract: Introduction: Formative and summative assessment were advised but formative assessment was useful too. The objective of this study was the determination of the effects of formative assessment on learning of ergonomics or human factors engineering. **Methods:** This article was a semi-experimental study which was done by using the curriculum, human factors engineering course was taught with formative assessment for group A and without formative assessment for group B then students' grades or data were analyzed by SPSS 16, mean, standard deviation, t-test with $P < 0.05$. **Results:** The total grade of human factors engineering in group A was 19.14 ± 0.79 and in group B, it was 17.76 ± 1.24 with $t = 4.677$ and $P < 0.001$ had significant differences. The specific lessons such as lifting, ergonomic chair, work physiology and low back pain were promoted and its mean grades were more in group A than B. **Conclusion:** According to the grades, formative assessments were useful for learning of human factors engineering.

Keywords: Summative assessment, Formative assessment, Ergonomics, Human factors engineering, Occupational health.

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INTRODUCTION:

Assessment methods are important in educational areas such as medical sciences engineering sciences and other sciences. Professors advised the use of different methods for assessment of students and these were included summative and formative assessment (Center E.2013, Malakan E. 2006).

According to scientific studies formative assessments were done during the course for example quizzes or small exams, write the statements, reports, filling the checklists or questionnaires could be the kinds of summative assessment (Center E.2013, Malakan E. 2006). The summative assessment was done at the end of the term such as terminal examination and the grade of this plays an important role in acceptance. The formative assessment must be has importance in learning, however these assessments were done during the term, teachers have a long time for changing their educational methods. The aim of these assessments is assessment for better learning, understanding the students' strengths points and their weaknesses. Professors should use curriculum for writing the educational programs such as course plans and lesson plans one of the main items in these plans is students' assessment.

According to the curriculum of health ministry occupational health field has general and specific courses. One of the specific courses is human factors engineering or ergonomics (Ministry of health, 2012).

In this course human being was studied as a machine. It is multi disciplinary field and it is included anthropometry, biomechanic, environmental physiology, work physiology, work psychology.

According to scientific studies; educational plans should be written according to responsibility for social needs, (Ministry of health, 2009, 2010, Strasser R *et al*, 2013) ergonomics is a health need and student must be pay attention to it for better learning because the many of cases with low back pain and other cumulative trauma disorders are related to unfitting the work stations (Haz-map, 2012, ILO 2012).

Some studies were worked on use of correct assessment for correct educational objectives (Oxford brookes university, 2017, Simon H. 2011). Dannefer E.F. demonstrated assessment practices can provide a typical culture for education that encourages learning (Dannefer E.F. 2013). May W. *et al* showed that learning was associated with performance of students on the summative assessment (May W *et al*, 2012). Althawi F. *et al* paid attention to promotion of students that is based on their formative assessment (Althawi F *et al*, 2012). O'sullivan A.J. *et al* demonstrated that formative assessment is suitable for students' preparation for understanding and effective learning (O' Sullivan A.J, *et al* 2012). Vleuten C.P.M. *et al* demonstrated that programmatic assessment was suitable for educational aim (Vleuten C.P.M *et al* ,

2012). These assessments could be done during the course (Driessen E. *et al*, 2013).

In this study, the author tries to find the effectiveness of formative assessment on occupational students' learning.

The objective is the determination the effects of formative assessment on students' learning of human factors engineering.

METHODS

This article was performed as a semi-experimental study on occupational health students. Group A included 75 students and group B75 too. Course plans were written according to curriculum.

Human factors engineering course was taught with lectures and presentation of power point. At each session and at the end of classes , student had been assessed in each group with some quizzes and tests and write the related checklist for the lessons as formative assessment. In human factors engineering chapters there were definitions, multi disciplinary science, work stations , ergonomic chairs, anthropometry , lifting, environmental physiology in mid term. In assessment after mid term there were work physiology, cumulative trauma disorders, low back pain, carpal tunnel

syndrome, shoulder disorders , shift work, psychological disorders. Researcher wanted to assessed effectiveness of formative assessment on learning of occupational health student. Quizzes and tests of the two groups were at the same level and prepared by teachers' opinions for correction and validity and there had been a pilot study with correlation of 0.87 for assigning the reliability in a sample of occupational health students. The inclusion criteria were the occupational health students in two entrance year and exclusion criteria were studying another field or having entered university in other years. Data were gathered in SPSS 16 and analyzed for calculation of means and $P < 0.05$. The researcher told that cumulative data were used and the names of the students were kept confidential.

RESULTS:

The total grade of human factors engineering in group A(with formative assessment) was 19.14 ± 0.79 and in group B(without formative assessment) ,it was 17.76 ± 1.24 with $t = 4.677$ and $P < 0.001$ had significant differences. The specific lessons such as lifting, ergonomic chair work physiology and low back pain were promoted and its mean grades were more in group A than B .

Table 1 shows the comparison of grades in human factors engineering chapters between the two groups before mid term.

Number	Subject	Grade of Ergonomy in group A	Grade of Ergonomy in group B	t-test	P value
1	Definitions	0.92 ± 0.18	0.91 ± 0.22	0.170	0.866
2	Multi disciplinary	1.00 ± 0	1.00 ± 0	-	-
3	work stations	0.92 ± 0.21	0.84 ± 0.27	1.162	0.251
4	ergonomic chairs	0.97 ± 0.12	0.79 ± 0.31	2.783	0.008
5	Anthropometry	1.00 ± 0	0.95 ± 0.17	1.414	0.164
6	Lifting	1.00 ± 0	0.75 ± 0.33	3.780	<0.001
7	Environmental physiology	0.97 ± 0.15	0.97 ± 0.10	0	1.00
8	Total	9.93 ± 0.14	8.58 ± 1.94	3.485	0.001

In specific lessons of occupational diseases such as ; lifting ($P = 0$), ergonomic chair ($P = 0.008$) and total ($P = 0.001$) there was a significant difference between two groups with $P < 0.05$ and the highest grade related to group A with summative assessment . In assessment of

lessons after mid term; work physiology ($P = 0.037$), low back pain ($P = 0.006$) and total ($P < 0.001$) there was a significant difference between two groups with $P < 0.05$ and the highest grade related to group A with summative assessment.

Table 2 – The comparison of grades in human factors engineering chapters between the two groups after mid term. (P<0.05)

Number	Variable	Grade of Ergonomy in group A	Grade of Ergonomy in group B	t-test	P value
1	Work physiology	0.54±0.43	0.28±0.43	2.146	0.037
2	Cumulative trauma disorders (CTD)	0.88±0.29	0.76±0.41	1.80	0.244
3	Low back pain (prevention)	0.89±0.21	0.60±0.45	2.868	0.006
4	Carpal tunnel syndrome (CTS)	0.96±0.13	0.92±0.23	0.730	0.469
5	Shoulder disorders	1.00±0	1.00±0	-	-
6	Shift work	0.85±0.25	0.88±0.33	-0.361	0.720
7	Work psychology	1.00±0	1.00±0	-	-
8	Total	9.45±0.46	9.00±0.52	3.201	0.002

DISCUSSION:

According to the results; the total grade was the best with formative assessment of human factors engineering. The human factors engineering learning levels had been promoted in teaching and assess with formative assessment for many chapters but for some of them were more important such as ; ergonomic chairs , lifting, work physiology and low back pain. Before the mid term ; definition, work station and anthropometry were more in group A but had not significant difference. Related sciences and environmental physiology were the same. After the mid term ; cumulative trauma disorders and carpal tunnel syndrome were more in group A but had not significant difference. Shoulder disorders and work psychology were the same. Shift work was more in group B but not significant difference. Health ministry' curriculums and educational programs can be helpful in teaching and assessing the students' learning. Scientists demonstrated the educational impact of assessment specially formative assessment for example direct objective procedural skills (Cobb K.A *et al*, 2013). Researchers showed that learning was related to changing curriculum and assessment methods that had been advised (Dijksterhuis M.G.K. *et al*, 2013). Scientists showed that according to the educational culture , there were more accommodation with formative assessment, but feedback should be done for deeper learning (Al-kadri H.M *et al* , 2013,2012). Some studies demonstrated the applications of formative assessments(Goldie J.,2013, Berk R.A,2013). The course of human factors engineering has some sessions such as definitions, work stations, ergonomic chairs, anthropometry , environmental physiology, lifting, work physiology, low back pain , cumulative trauma disorders , shoulder disorders, carpal tunnel syndrome, work psychology and shift work. In the overall formative assessment had an important effect on students' learning of human factors engineering course. The greater effects were on practical and helpful

subjects for future works such as lifting and low back pain (prevention). The formative assessment had not straight effect on related sciences or multi disciplinary, environmental physiology, shoulder disorders and shift work but it had an important effect on total grades. Students' grades in shift work were more in group B because this lesson was near the end of the course and teacher gave them more time for writing the checklist until the end.

Limitations

The number of students with two entrance years to university. Another study is recommended with more students with the same entrance year.

Recommendations:

This study recommends that formative assessment is effective for students' learning.

CONCLUSION:

According to the grades , formative assessment were more useful for learning.

Conflict of interest statement: The author declares no conflict of interest.

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REFERENCES

1. Al-Kadri, H. M., Al-Kadi, M. T., & Van Der Vleuten, C. P. (2013). Workplace-based assessment and students' approaches to learning: a qualitative inquiry. *Medical teacher*, 35(sup1), S31-S38.
2. Al-Kadri, H. M., Al-Moamary, M. S., Roberts, C., & Van der Vleuten, C. P. (2012). Exploring assessment factors contributing to students' study

- strategies: literature review. *Medical teacher*, 34(sup1), S42-S50.
3. Altafawi, F., Sisk, B., Poloskey, S., Hicks, C., & Dannefer, E. F. (2012). Student perspectives on assessment: experience in a competency-based portfolio system. *Medical teacher*, 34(3), 221-225.
 4. Barnamehdoros, deputy ministry for education. (2012) secretariat of the council for education in medical basic sciences , public health and post graduate, [Accessed 2012 Jun 3] Available from: [http://mbs . behdasht . gov.ir / uploads/176_315_barnamehdoros_ kardaniHerfee.pdf](http://mbs.behdasht.gov.ir/uploads/176_315_barnamehdoros_kardaniHerfee.pdf)
 5. Berk, R. A. (2013). Top five flashpoints in the assessment of teaching effectiveness. *Medical Teacher*, 35(1), 15-26.
 6. Center E, (2013)What is the difference between formative and summative assessment? Eberly Center(teaching excellence and educational innovation), [Accessed 2013 Jun 28] Available from: <http://www.cmu.edu>
 7. Cobb, K. A., Brown, G., Jaarsma, D. A., & Hammond, R. A. (2013). The educational impact of assessment: a comparison of DOPS and MCQs. *Medical teacher*, 35(11), e1598-e1607.
 8. Dannefer, E. F. (2013). Beyond assessment of learning toward assessment for learning: educating tomorrow's physicians. *Medical teacher*, 35(7), 560-563.
 9. Dijksterhuis, M. G., Schuwirth, L. W., Braat, D. D., Teunissen, P. W., & Scheele, F. (2013). A qualitative study on trainees' and supervisors' perceptions of assessment for learning in postgraduate medical education. *Medical teacher*, 35(8), e1396-e1402.
 10. Driessen, E., & Scheele, F. (2013). What is wrong with assessment in postgraduate training? Lessons from clinical practice and educational research. *Medical teacher*, 35(7), 569-574.
 11. Goldie, J. (2013). Assessment of professionalism: A consolidation of current thinking. *Medical teacher*, 35(2), e952-e956.
 12. Malakan Rad, E., Einollahi, B., Hosseini, S. J., & Momtaz Manesh, N. (2006). Clinical teaching and assessment what every clinical teacher must know. *Tohfeh with Boshra*, 1, 1-40.
 13. May, W., Chung, E. K., Elliott, D., & Fisher, D. (2012). The relationship between medical students' learning approaches and performance on a summative high-stakes clinical performance examination. *Medical Teacher*, 34(4), e236-e241.
 14. Methods of assessment,(2017) oxford brookes university, [Accessed 2017 Jun 25] Available from [https://www.brookes.ac.uk/services/ocslid/resources /methods.html](https://www.brookes.ac.uk/services/ocslid/resources/methods.html)
 15. Ministry of Health and Medical Education (2009) community oriented medical education [Accessed 2009 Aug 20] Available from: [http:// dme .mohme.gov.ir / motaleat / motaleatvatoseeh / jamenegar / moarefi .htm](http://dme.mohme.gov.ir / motaleat / motaleatvatoseeh / jamenegar / moarefi .htm)
 16. Ministry of Health and Medical Education (2009) social accountable medical education , [Accessed 2010 Apr 5] Available from: [http:// edc.behdasht.gov.ir/uploads/ 180_366_moarefi_pashokhgo .htm](http://edc.behdasht.gov.ir/uploads/180_366_moarefi_pashokhgo .htm)
 17. Ministry of Health and Medical Education ,(2010) social accountable medical education, [Accessed 2010 Apr 5] Available from: [http:// edc.behdasht.gov.ir/uploads/ 180_366_barnameh_pashokhgo .htm](http://edc.behdasht.gov.ir/uploads/180_366_barnameh_pashokhgo .htm)
 18. Occupational diseases,(2012) Haz-Map, [Accessed 2012 Jun 25] Available from: <http://www.hazmap.nlm.nih.gov>
 19. O'sullivan, A. J., Howe, A. C., Miles, S., Harris, P., Hughes, C. S., Jones, P., ... & Leinster, S. J. (2012). Does a summative portfolio foster the development of capabilities such as reflective practice and understanding ethics? An evaluation from two medical schools. *Medical teacher*, 34(1), e21-e28.
 20. Safety and health at work,(2012) International labor organization, [Accessed 2012 Jun 25] Available from: <http://www.ilo.org>
 21. Sarfasledoros, deputy ministry for education. (2012) secretariat of the council for education in medical basic sciences , public health and post graduate, [Accessed 2012 Jun 1] Available from: [http:// mbs . behdasht . gov.ir / uploads/176_315_sarfasledoros_ kardaniHerfee.pdf](http://mbs.behdasht.gov.ir/uploads/176_315_sarfasledoros_kardaniHerfee.pdf)
 22. Simon H, (2011)Principles of teaching and learning ,med. fsu . edu , [Accessed 2009 Dec14] Available from: [http :// www.med. fsu . edu / education / faculty development / principles _ teach _ learn . asp](http://www.med.fsu.edu/education/facultydevelopment/principles_teach_learn.asp)
 23. Strasser R, Hogenbirk J.C, Minore B, Marsh D.C, Berry S, Mccready W .G, Graves L ,(2013)Transforming health professional education through social accountability: Canada's Northern Ontario School of Medicine,*Medical Teacher*, 35 (6): 490-496
 24. Vleuten C.P.M , Schuwirth L. W. T, Driessen E. W, Dijkstra J, Tigelaar D, Baartman L. K. J, Tartwijk J,(2012)A model for programmatic assessment fit for purpose,*Medical Teacher* , 34 (3): 205-214