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Seven-Year Analysis of Scores Obtained in Formative Assessment Practical Examinations by First-Year MBBS Students in Physiology

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Abstract: This complete enumeration, cross-sectional comparative record-based study was conducted at a municipal medical college in Maharashtra state, India. First-year MBBS students undergo formative assessment (one terminal examination and one preliminary examination) before they appear for First MBBS University examinations (summative assessment). Marks scored by the First-year MBBS students in terminal and preliminary practical examinations during the seven year period (2011-2017) were statistically analysed. In the terminal practical examination, the gender difference in the average marks scored in terminal practical examinations was statistically significant (Z=2.226; p=0.026) only for Batch 2013, while in the preliminary practical examination the gender difference was statistically significant for Batch 2011 (Z=2.094; p=0.036) and Batch 2017 (Z=2.139; p=0.032). The marks obtained in preliminary practical examination exhibited less variability as compared to that in the terminal practical examination. This study may serve as a springboard towards further research on student assessment in the subject of Physiology.

Keywords: Analysis, Formative assessment, Gender differences, Physiology, Practical examination.

INTRODUCTION

Didactic lectures continue to be the predominant teaching method for students in the basic medical courses [1], despite the initiation of novel evidence-based revisions to teaching and learning environments [2]. With the exception of student seminars and tutorials, academic activities in basic medical courses continue to be primarily teacher-centred and teacher-driven.

The tutorial [3] is an interactive session where students express their opinions, ask questions and enhance their communication skills.

As per the guidelines of the Maharashtra University of Health Sciences, affiliated medical colleges should conduct formative assessment-one terminal (term-ending) examination and one preliminary examination - for First-year MBBS students before they appear for First MBBS University examinations (summative assessment). Formative assessments have their own limitations since the terminal and preliminary examinations are conducted by the same teachers who are also involved in teaching the same set of students [1]. External examiners participate only in the summative assessment during examinations conducted by the Maharashtra University of Health Sciences. The practical examination in Physiology (total 40 marks) consists of haematology (10 marks) and clinical physiology (20 marks), and short exercises (10 marks). Viva voce is conducted at all the stations. However, this method of assessment is not sufficiently comprehensive to test the practical skills and attitudes needed by future doctors [4].

The practical examination helps assessing the students' psychomotor and cognitive domain. The viva voce component of practical examination determines the cognitive domain and the ability of the student to communicate. Generally, the students who appear for practical examination in the First-year MBBS do not have prior experience of viva voce examinations, where verbal communication skills are necessary. The academic years 2011-2017 was chosen for the purpose of this study because there were no changes in the examination pattern or syllabus during this period and by and large, the same set of teachers taught various topics in the subject of Physiology. Thus, the effect of possible confounders would be minimized.

This study was conducted to analyse the scores of First-year MBBS students during formative assessment (terminal and preliminary practical examinations) in the subject of Physiology.

MATERIALS AND METHODS

This complete enumeration, cross-sectional comparative record-based study was conducted at a municipal medical college in Maharashtra state, India.

This medical college is affiliated to the Maharashtra University of Health Sciences. Marks scored by the First-year MBBS students in terminal and preliminary practical examinations during the seven year period (2011-2017) were obtained from records in the department of Physiology. Confidentiality was maintained since the names of the students were not revealed.

The data were statistically analyzed using EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA). Continuous data were presented as Mean and Standard Deviation (SD). 95% Confidence interval (CI) was stated as: "[Mean - (1.96)*Standard Error)] - [Mean + (1.96)*Standard Error)]". Standard error of difference between two means was used to determine the statistical significance of difference between two means. Statistical significance was determined at $p<0.05$.

RESULTS AND DISCUSSION

Terminal practical examination scores

The gender difference in the average marks scored in terminal practical examinations was statistically significant ($Z=2.226$; $p=0.026$) only for Batch 2013. (Table-1) The gender difference in maximum marks, third quartile, median, first quartile and minimum marks scored in terminal practical examinations is depicted in Figure-1. The median marks were nearly identical for male and female students of Batch 2011 and Batch 2016. The maximum scores for males were higher only in Batches 2012 and 2015. Higher variability in marks was seen among male students of four batches (2011, 2012, 2013 and 2015) while this was seen among female students of one batch only (Batch 2017). Higher variability in scores among boys has been reported [5].

Preliminary practical examination scores

The gender difference in the average marks scored in preliminary practical examinations was statistically significant for Batches 2011 ($Z=2.094$; $p=0.036$) and 2017 ($Z=2.139$; $p=0.032$). (Table-1) Overall, the marks obtained in preliminary practical examination exhibited less variability as compared to that in the terminal practical examination. (Figure-2) The median marks were nearly identical for male and female students of Batch 2012 and Batch 2013. The maximum scores were higher for male students of four batches (2012, 2013, 2016 and 2017). Higher variability in scores was seen among male students of three batches (2012, 2013 and 2015) while among female students, the variability in marks had reduced as compared to that in the terminal practical examination.

In the subject of Physiology, verbal skills are necessary at all Practical Stations. The existence of a gender gap in academic scores has been studied and the available evidence suggests that females outperform males in tests that involve verbal recall [6-8]. Social conditioning and gender-biased environments can affect academic scores [9] and that the gender gap in scores disappears in more gender-equal societies [10].

While entering the educational system, both males and females retain their gender-specific behaviours, attitudes and values [11], which are a consequence of their socialization in conformity with the prevailing social norms of masculinity and femininity since their childhood [12]. In educational institutions, it is postulated that male behaviour, values and attitudes impede males' educational accomplishment [13].

Students have individual learning style preferences viz. learning from graphs, charts, and flow diagrams ("Visual"), learning from speech ("Auditory"), learning from reading and writing ("Read-write"), and learning from touch, hearing, smell, taste, and sight ("Kinaesthetic"). These learning preferences can be assessed using the VARK (V=Visual, A=Auditory, R=Read-write, K=Kinaesthetic) questionnaire [14]. Teachers who are familiar with the diversity of learning styles can enhance student motivation and performance by creating suitable learning approaches to match the learning style preferences of students [15]. Use of suitable learning style approaches among remedial students has resulted in significantly higher achievement [16].

It has been reported that anxiety levels, caused by poor performance in formative assessment, led to increased "rote-learning", which correlated with poor performance in summative assessment [17]. Hence, formative assessment examinations should be designed to identify the academically weaker students, who might need remedial sessions and extra assistance [18].

Table-1: Marks obtained in Terminal Examinations (out of 40)

Batch	Gender	No.	Mean	SD	95% CI	Z value	p value
2011	Males	29	25.24	4.40	23.64 - 26.84	0.544	0.586
	Females	31	25.81	3.65	24.52 - 27.09		
2012	Males	28	24.54	4.89	22.76 - 26.38	0.034	0.972
	Females	32	24.50	3.89	23.15 - 25.85		
2013	Males	25	23.36	4.35	21.66 - 25.06	2.226	0.026 *
	Females	35	25.77	3.81	24.51 - 27.03		
2014	Males	27	27.80	3.77	26.38 - 29.22	1.338	0.180
	Females	33	26.48	3.84	25.17 - 27.80		
2015	Males	20	23.90	6.89	20.88 - 26.92	0.941	0.346
	Females	40	25.48	4.20	24.17 - 26.78		
2016	Males	28	24.89	3.22	23.70 - 26.09	0.829	0.407
	Females	31	25.68	4.08	24.24 - 27.11		
2017	Males	33	26.97	3.49	25.78 - 28.16	0.513	0.607
	Females	29	27.45	3.82	26.06 - 28.84		

SD = Standard Deviation; CI = Confidence Interval; Z = Standard Error of difference between means
* Statistically significant at p<0.05

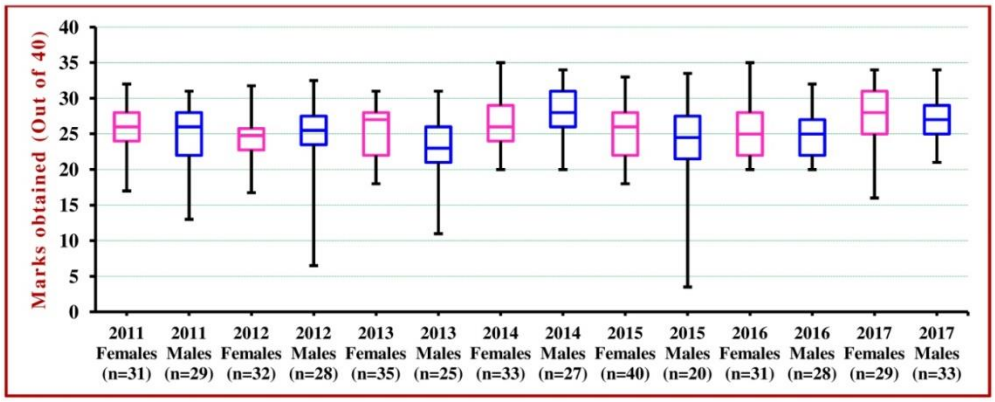

Fig-1: Boxplot of marks obtained in Terminal Practical examinations

Table-2: Marks obtained in Preliminary Examinations (out of 40)

Batch	Gender	No.	Mean	SD	95% CI	Z value	p value
2011	Males	29	25.38	3.36	24.16 - 26.60	2.094	0.036 *
	Females	31	27.19	3.33	26.02 - 28.37		
2012	Males	28	24.68	5.44	22.66 - 26.70	1.441	0.149
	Females	32	26.38	3.27	25.24 - 27.51		
2013	Males	25	24.24	4.04	22.65 - 25.83	1.234	0.217
	Females	35	25.40	2.84	24.46 - 26.34		
2014	Males	27	26.76	2.54	25.80 - 27.72	1.189	0.234
	Females	33	25.88	3.19	24.79 - 26.97		
2015	Males	20	26.70	4.80	24.59 - 28.81	1.602	0.109
	Females	40	28.58	2.99	27.65 – 29.50		
2016	Males	28	27.89	3.60	26.56 - 29.23	0.903	0.366
	Females	31	27.06	3.44	25.85 - 28.28		
2017	Males	33	25.64	3.83	24.33 - 26.94	2.139	0.032 *
	Females	29	27.66	3.60	26.35 - 28.96		

SD = Standard Deviation; CI = Confidence Interval; Z = Standard Error of difference between means
* Statistically significant at p<0.05

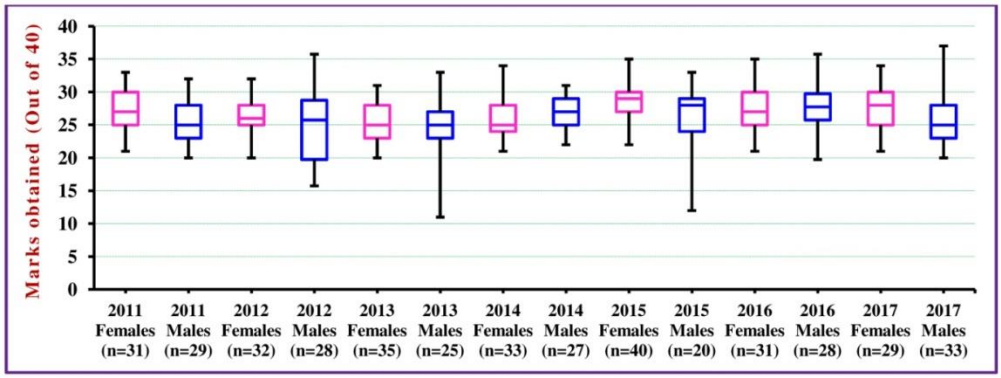

Fig-2: Boxplot of marks obtained in Preliminary Practical examinations

CONCLUSION

The gender difference in the mean scores was observed in all batches but was statistically significant only for some batches. Higher variability in marks was found among male students. The scores in preliminary practical examination exhibited less variability as compared to that in the terminal practical examination. Though this study was confined to the subject of Physiology, this may serve as a launch pad towards further research on student assessment in the subject of Physiology.

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