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# Effect of reflective thinking on academic performance among undergraduate dental students

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## Abstract:

**INTRODUCTION:** Self-directed learning is a vital principle promoted in health profession's education, particularly with the increasing use of online learning methods. Likewise, reflection has been recognized as an indispensable and formidable concept for learning which plays a positive role in fostering students' self-reflection, critical thinking, and development of professional values and skill. Hence, the present study was undertaken to identify the effect of reflective thinking on academic performance among undergraduate dental students.

**MATERIALS AND METHODS:** Reflective thinking was assessed among 2<sup>nd</sup>-, 3<sup>rd</sup>-, and 4<sup>th</sup>-year undergraduate dental students and interns of a dental college and hospital in Hyderabad. Reflection questionnaire assessed habitual action, understanding, reflection, and critical reflection on a 5-point Likert scale. The percentage of marks obtained in the last university examinations was considered for academic performance. The completed questionnaires were analyzed using the Statistical Package for the Social Sciences software (SPSS version 20).  $P < 0.05$  was considered statistically significant.

**RESULTS:** A total sample of 263 individuals comprising 188 (71.5%) females and 75 (28.5%) males participated in the study. Our findings showed that the four scales of reflective thinking, such as habitual action ( $P = 0.0001^*$ ), understanding ( $P = 0.02^*$ ), reflection ( $P = 0.02^*$ ), and critical reflection ( $P = 0.01^*$ ), showed statistically significant difference based on the year of study. However, no difference based on gender was noted. Reflection ( $17.2 \pm 2.41$ ) and critical reflection ( $16.3 \pm 2.77$ ) mean scores were highest among 4<sup>th</sup> years. Higher understanding ( $17.83 \pm 1.78$ ) and reflection ( $17.33 \pm 2.01$ ) mean scores were observed among students who attained more than 75% in their academic performance.

**CONCLUSION:** Thus, the present study emphasizes the role of reflective thinking and its significance in academic learning process.

## Keywords:

Academic performance, dental students, reflective thinking

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## Introduction

Cardinal to the practice of medicine is the concept of self-regulation and a commitment to lifelong learning. Medical students are expected to undertake much of their learning in the form of self-directed study rather than being passive recipients of didactic teaching.<sup>[1]</sup> Self-directed learning is a vital principle promoted in health profession's education, particularly with the increasing use of online learning methods. Self-directed

learning as defined by Knowles is "a process in which individuals take the initiative, with or without the help of others, in diagnosing their needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes."<sup>[2]</sup>

Aspects of learning include experiential learning and work-based learning. In experiential learning, learning is based on experience. It says that there is a concrete experience, followed by reflection on it, then

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abstract conceptualization, and further experimentation and improvement. Work-based learning provides students with real-life work where they can apply academic and technical skills and develop their employability.<sup>[2,3]</sup>

Likewise, reflection has been recognized as an indispensable and formidable concept for learning which as highlighted by Dewey plays a positive role in fostering students' self-reflection, critical thinking, and development of professional values and skill.<sup>[4,5]</sup> Thus, reflection is an "important human activity in which people recapture their experience, think about it, mull it over, and evaluate it. It is this working with experience that is important in learning."<sup>[5]</sup> Reflection allows integration of new learning into existing knowledge and skill which encourages students to engage with their experiences to grow. The ability to reflect is increasingly being identified as an essential component of medical professionalism. Reflection in medical profession can improve, develop, or promote several attributes such as clinical reasoning, diagnostic abilities particularly in complex and unusual cases, technical skills, evidence-based decisions, and professionalism.<sup>[5]</sup> The process of reflection can help reduce the theory–practice gap and therefore enables health-care practitioners to re-evaluate and transform their professional practice.<sup>[6]</sup>

The four facets of reflective thinking that are habitual action, understanding, reflection, and critical reflection act as mediators between learning approaches, study strategies, goal orientations, and academic performance.<sup>[7]</sup> Academic success (high-grade point average) has a great influence on a student's self-esteem, motivation, and perseverance in higher education. Poor academic performance or high failure rates may result in unacceptable levels of attrition and increased cost of education.<sup>[8]</sup> Hence, the present study was undertaken to identify the effect of reflective thinking on academic performance among undergraduate dental students.

## Materials and Methods

The study sample comprised of 2<sup>nd</sup>-, 3<sup>rd</sup>-, and 4<sup>th</sup>-year undergraduate dental students and interns of a dental college and hospital in Hyderabad. Anonymity and confidentiality of respondents were maintained, and participation was voluntary. Ethical approval for this study was obtained from the Institutional Review Board (PMVIDSandRC/IEC/PHD/PR/0265-2018). Permission to conduct the study was obtained from the principal prior to the survey procedure.

The survey tool comprised of reflection questionnaire (RQ) developed by Kember *et al.*<sup>[7]</sup> It is a 16-item instrument comprising four scales that quantitatively assess two levels of non-reflective actions such as habitual action

(1, 5, 9, and 13) and understanding (2, 6, 10, and 14) and two levels of reflective actions such as reflection (3, 7, 11, and 15) and critical reflection (4, 8, 12, and 16). The responses were recorded on a 5-point Likert scale from 1 (definitely agree) to 5 (definitely disagree). Thus, each of the four scales was measured by four items, and the respondent's score on each of these scales was calculated by adding the response score for each of the four items. The score ranged from a minimum of 4 to a maximum of 20 for each scale. The higher the score, the more agreement with engaging in that particular scale and there is no overall score.

The percentage of marks obtained in the last university examinations was considered for academic performance and was graded as >75%, 65%–75%, and <60%. Apart from this, the respondent's gender and year of study were also recorded.

The questionnaire was distributed to undergraduate dental students during lecture hours in the classroom, and the respondents were instructed not to discuss the questions among themselves. Throughout the duration of the study, participants were given the opportunity to leave if they experienced any form of discomfort. After completing the questionnaire, participants were thanked for volunteering.

The completed questionnaires were collected; data were entered and analyzed using the IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. *t*-test and one-way ANOVA test were used for comparison among items of the questionnaire based on variables. Differences were tested at a significant level of  $P \leq 0.05$ .

## Results

The final sample comprised of 263 (response rate of 93.9%), which included 75 (28.5%) males and 188 (71.5%) females. Majority of the participants belonged to 2<sup>nd</sup> years (71, 27%), followed by interns (68, 25.9%), 4<sup>th</sup>-year dental students (63, 24%), and 3<sup>rd</sup>-year dental students (61; 23.1%) [Table 1].

It was observed that only a small percentage of individuals (3.4%) secured <60% in their previous year of study with majority of them being males and 2<sup>nd</sup> years. Most of the study population scored 60%–75%, 160 (85.1%) were females, and majority of them belonged to interns (92.6%). The higher percentage of >75% was scored by males (13; 17.3%) and 2<sup>nd</sup> years (18; 25.3%) as compared to females (23; 12.2%) and other years of study. No significant gender difference was observed; however, a statistically significant difference was observed based on the year of study ( $P = 0.0041$ ) [Table 2].

**Table 1: Demographic distribution of study population-based variables**

Variables	n (%)
Gender	
Males	75 (28.5)
Females	188 (71.5)
Year of study	
2 <sup>nd</sup>	71 (27)
3 <sup>rd</sup>	61 (23.1)
4 <sup>th</sup>	63 (24)
Interns	68 (25.9)
Total	263 (100)

**Table 2: Association of academic performance based on variables**

Variables	<60%, n (%)	60%-75%, n (%)	>75%, n (%)	Total, n (%)	P
Gender					
Males	4 (5.4)	58 (77.3)	13 (17.3)	75 (28.5)	0.28
Females	5 (2.7)	160 (85.1)	23 (12.2)	188 (71.5)	
Year of study					
II	4 (5.6)	49 (69)	18 (25.4)	71 (27)	0.004
III	0 (0.0)	54 (88.5)	7 (11.5)	61 (23.1)	
IV	2 (3.2)	52 (82.5)	9 (14.3)	63 (24)	
Interns	3 (4.5)	63 (92.6)	2 (2.9)	68 (25.9)	
Total	9 (3.4)	218 (82.9)	36 (13.7)	263 (100)	

Majority of the study population responded for the option “definitely agree” and “agree with reservation” for most of the items of RQ. However, RQ-9, i.e., “as long as I can remember handout material for examinations, I do not have to think too much” had majority of responses as “not sure” (34.2%) [Table 3].

The four scales of reflective thinking such as habitual action ( $P = 0.0001^*$ ), understanding ( $P = 0.02^*$ ), reflection ( $P = 0.02^*$ ), and critical reflection ( $P = 0.01^*$ ) showed statistically significant difference based on the year of study. Habitual action mean scores were highest among interns ( $15.19 \pm 2.55$ ) whereas 3<sup>rd</sup> years exhibited greater understanding scores ( $17.9 \pm 1.80$ ). Reflection ( $17.2 \pm 2.41$ ) and critical reflection ( $16.3 \pm 2.77$ ) scores were higher among 4<sup>th</sup> years when compared to other years. Overall, the total reflection scales did not show any significant difference based on gender, year of study, and academic performance [Table 4].

For percentage <60%, females showed a significantly higher odds for all scales with 3.8 times for habitual action, 1.6 times for understanding, 1.7 times for reflection, and 2.3 times for critical reflection as compared to males. Based on the year of study, 4<sup>th</sup> years showed

**Table 3: Frequency distribution of responses for reflection questionnaire among the study population**

No	Items	RQ				
		n (%)				
		Definitely agree 1	Agree with reservation 2	Not sure 3	Disagree with reservation 4	Definitely disagree 5
1	When I am working on some activities, I can do them without thinking about what I am doing	47 (17.9)	82 (31.2)	59 (22.4)	19 (7.2)	56 (21.3)
2	This course requires us to understand concepts taught by the lecturer	172 (65.4)	57 (21.7)	24 (9.1)	7 (2.7)	3 (1.1)
3	I sometimes question the way others do something and try to think of a better way	104 (39.5)	98 (37.3)	47 (17.9)	12 (4.6)	2 (0.7)
4	As a result of this course I have changed the way I look at myself	107 (40.7)	79 (30.0)	50 (19.0)	14 (5.3)	13 (5)
5	In this course we do things so many times that I started doing them without thinking about it	74 (28.1)	93 (35.4)	61 (23.2)	23 (8.8)	12 (4.5)
6	To pass this course you need to understand the content	184 (69.9)	44 (16.7)	23 (8.8)	8 (3.1)	4 (1.5)
7	I like to think over what I have been doing and consider alternative ways of doing it	105 (40)	112 (42.6)	35 (13.3)	7 (2.6)	4 (1.5)
8	This course has challenged some of my firmly held ideas	105 (39.9)	77 (29.3)	57 (21.7)	16 (6.1)	8 (3.0)
9	As long as I can remember handout material for examinations, I do not have to think too much	44 (16.7)	75 (28.6)	90 (34.2)	29 (11.0)	25 (9.5)
10	I need to understand the material taught by the teacher in order to perform practical tasks	151 (57.4)	74 (28.1)	27 (10.3)	7 (2.7)	4 (1.5)
11	I often reflect on my actions to see whether I could have improved on what I did	141 (53.6)	81 (30.8)	32 (12.2)	5 (1.9)	4 (1.5)
12	As a result of this course I have changed my normal way of doing things	98 (37.3)	84 (31.9)	54 (20.5)	17 (6.5)	10 (3.8)
13	If I follow what the lecturer says, I do not have to think too much on this course	69 (26.2)	93 (35.4)	69 (26.2)	17 (6.5)	15 (5.7)
14	In this course you have to continually think about the material you are being taught	81 (30.8)	99 (37.6)	57 (21.7)	16 (6.1)	10 (3.8)
15	I often re-appraise my experience so I can learn from it and improve for my next performance	116 (44.1)	96 (36.5)	40 (15.2)	7 (2.7)	4 (1.5)
16	During this course I discovered faults in what I had previously believed to be right	103 (39.2)	77 (29.3)	53 (20.1)	13 (4.9)	17 (6.5)

RQ=Reflection questionnaire

higher odds for habitual action (2.4), understanding (1.6), and reflection (1.2) with a statistically significant difference ( $P = 0.03^*$ ).

Likewise, among individuals scoring 60%–75%, females exhibited higher odds for habitual action (1.1) while 2<sup>nd</sup> years had higher odds for critical reflection (1.1). Third years showed higher odds for habitual action (1.1) and critical reflection (1.3) and 4<sup>th</sup> years demonstrated higher odds for habitual action (1.1) and understanding (1.1) ( $P < 0.05^*$ ). For individuals scoring >75%, higher odds for habitual action (1.3) was noted for females and 2<sup>nd</sup>-year students had higher odds for reflection (2.5;  $P < 0.001^*$ ) and critical reflection (1.9); meanwhile, 3<sup>rd</sup> years demonstrated higher odds for critical reflection (1.1) ( $P < 0.05^*$ ) [Table 5].

### Discussion

Reflection is an indispensable element of learning and includes the act of thinking about what one has learned, as well as how one has learned it.<sup>[9]</sup> Being reflective in simpler terms is to have a heightened awareness

during and after experiences and to be enthusiastic to learn from the experiences.<sup>[10]</sup> Ashley *et al.*<sup>[11]</sup> suggested that reflection, on both process and content of learning, could help students move toward a deeper approach to learning. Hence, reflection allows the integration of new learning into existing knowledge and skills and enhances learning to a deeper approach.

Interest in the use of reflection in medical curriculum has grown in recent years.<sup>[12]</sup> Medical students as learners and later on as practitioners are constantly developing in their skills, and it is important that they reflect on how they respond to different situations, so that they can tackle problems through thoughtful and considerate action.<sup>[12]</sup> In the field of dentistry, reflection on both the process and content of learning can help students control their learning and influence their academic performance.<sup>[13]</sup>

According to Kember *et al.*, reflective thinking includes reflective and nonreflective actions. Nonreflective actions are identified as habitual action and understanding.

**Table 4: Comparison of reflection questionnaire scores among study population based on gender, year of study, and academic performance**

Variables	Total	Habitual action	Understanding	Reflection	Critical reflection
Gender					
Males	64.63±6.47	14.40±3.09	17.13±1.95	17.04±2.15	16.05±3.08
Females	63.30±6.70	13.74±2.85	17.24±2.52	16.69±2.27	15.63±2.85
<i>P</i>	0.14	0.09	0.74	0.25	0.29
Year of study					
II	64.44±6.01	13.92±2.77	17.39±2.25	17.11±1.90	16.01±2.65
III	62.90±5.99	13.72±2.79	17.89±1.80	16.61±2.24	14.69±3.33
IV	63.19±7.76	12.78±3.15	16.87±2.91	17.24±2.41	16.30±2.77
Interns	64.04±6.75	15.19±2.55	16.72±2.26	16.21±2.30	15.93±2.73
<i>P</i>	0.51	0.0001*	0.02*	0.02*	0.01*
Academic performance (%)					
<60	66.89±5.62	14.78±1.99	18.00±1.66	16.78±2.39	17.33±1.87
60-75	63.36±6.77	13.90±2.98	17.07±2.46	16.70±2.27	15.68±2.90
>75	64.83±5.87	13.86±2.85	17.83±1.78	17.33±2.01	15.81±3.21
<i>P</i>	0.15	0.67	0.12	0.29	0.24

\* $P < 0.05$  statistically significant

**Table 5: Multiple logistic regression analysis of academic performance based on individual scales according to gender and year of study**

Variables	Academic performance <60%					Academic performance 60%-75%					Academic performance >75%				
	HA	UD	REF	CR	Total	HA	UD	REF	CR	Total	HA	UD	REF	CR	Total
Gender															
Male	Reference					Reference					Reference				
Female	3.8	1.6	1.7	2.3	1.5	1.1	0.9	1.0	1.0	0.9	1.3	1.0	0.8	1.0	1.1
<i>P</i>	0.001*	0.001*	0.001*	0.001*	0.001*	0.19	0.14	0.28	0.27	0.15	0.28	0.83	0.44	0.86	0.95
Year of study															
II	0.5	0.8	0.2	0.3	0.3	1.0	0.9	0.8	1.1	0.9	0.2	0.6	2.5	1.9	0.5
III	0.6	0.9	0.8	0.9	0.7	1.1	0.7	0.2	1.3	0.9	0.2	0.7	0.9	1.1	0.8
IV	2.4	1.6	1.2	0.9	0.5	1.1	1.1	0.7	1.0	1.0	0.2	0.5	0.4	0.9	0.6
Interns	Reference					Reference					Reference				
<i>P</i>	0.03*	0.20	0.14	0.325	0.47	0.26	0.42	0.53	0.05*	0.41	0.68	0.94	0.001*	0.05*	0.81

HA=Habitual action, UD=Understanding, REF=Reflection, CR=Critical reflection. \* $P < 0.05$  statistically significant

Habitual action is that which has been learned before and through frequent use becomes an activity that is performed with little conscious thought. Understanding is when the learner acts to comprehend and apply knowledge within contextual constraints, without recognizing personal significance. Likewise, reflective actions such as reflection involve the learner assessing the problem-solving process and use this to make reflection. Critical reflection involves us becoming aware of why we perceive, think, feel, or act as we do.<sup>[7]</sup>

Recognizing this importance, the present study was designed to investigate the effect of reflective thinking on academic performance among undergraduate dental students. The RQ by Kember *et al.* was preferred as the psychometric properties of this instrument, as established by the use of confirmatory factor analysis, showed a good fit to the intended factor structure. The instrument is simple and not very time-consuming. Other methods to assess reflective thinking are reflective journals,<sup>[14]</sup> student interviews, and classroom observation.<sup>[15]</sup> These methods have a major disadvantage of needing longer time for data gathering and analysis.

In the present study, majority of the students (82.8%) obtained 60%–75% in their last year university academic examination. These findings conflict with the results reported by Lakshminarayan *et al.*<sup>[16]</sup> among dental students in Davangere, where high percentage of dental students scored <60% in their university examination. This, as reported by authors, could be due to their inability to balance their academic and clinical responsibilities simultaneously, thereby securing poor grades.

Majority of the study population responded “definitely agree” and “agree with reservation” for most of the items of RQ. This suggests that students are in a learning phase, identifying their skills and strengths, and rectifying mistakes which helps them develop actions for change and future success. Likewise, among dental students<sup>[17]</sup> enrolled at King’s College London Dental Institute and medical imaging undergraduates<sup>[18]</sup> in University of Kebangsaan, Malaysia, the individuals agreed with most of the items of RQ.

Ottenberg *et al.*<sup>[19]</sup> reported that Minnesota female medical students had higher mean composite reflection scores (1.70) than male students (1.48). This could be due to the fact that females tend to have a positive attitude toward their profession, do not avoid taking responsibility, and act sincerely.<sup>[20]</sup> This finding disagreed with our results along with the other similar studies by Lew and Schmidt<sup>[5]</sup> and Tricio *et al.*<sup>[2]</sup> in which no significant gender differences were observed.

The four scales of reflective thinking such as habitual action ( $P = 0.0001^*$ ), understanding ( $P = 0.02^*$ ), reflection ( $P = 0.02^*$ ), and critical reflection ( $P = 0.01^*$ ) showed statistically significant difference based on the year of study. Reflection ( $17.2 \pm 2.41$ ) and critical reflection ( $16.3 \pm 2.77$ ) scores were highest among 4<sup>th</sup> years when compared to other years. This could be because theory and concept integration into students’ and trainees’ practice increases as they climb the program ladder. It is acknowledged that dental students are required to develop reflective thinking and problem-solving skills as they move from well-defined problems in the classroom environment to the more uncertain and ill-defined real-life situations when they start clinical patient care.<sup>[21]</sup> However, these results were in contrast to the study by Chelliah and Arumugam<sup>[18]</sup> among Malaysian medical imaging undergraduates where there was no significant difference in the level of reflection based on the year of study.

In this study, reflection had the highest and significant influence on academic performance (odds ratio = 2.5). Reflection is formed from a deep learning approach, wherein learners overcome fears and uncertainties to critically evaluate their practice in order to make meaningful change. These findings are supported by Ghanizadeh<sup>[22]</sup> among Iranian university students who reported reflection to be the strongest predictor of achievement. Thus, the practice of reflection among students can exhibit high academic scores.

The present study acknowledges certain limitations such as single institution and cross-sectional nature of the study; hence, the results should be generalized with caution. Another drawback of the current study is that a qualitative approach could be complemented along with the current quantitative design.

## Conclusion

The present study showed that the four scales of reflective thinking had statistical significance based on year of study; however, no difference based on gender was noted. The reflection and critical reflection mean scores were highest among 4<sup>th</sup> years. Higher “understanding” and “reflection” mean scores were observed among students who attained >75% in their academic performance. “Reflection” has the highest influence on academic performance. Thus, the present study emphasizes the role of reflective thinking and its significance in academic learning process.

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## Conflicts of interest

There are no conflicts of interest.

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