

CORRELATIONS BETWEEN ACADEMIC ACHIEVEMENT AND ANXIETY AND DEPRESSION IN MEDICAL STUDENTS EXPERIENCING INTEGRATED CURRICULUM REFORM

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This study aimed to examine the correlations between academic achievement and levels of anxiety and depression in medical students who were experiencing curriculum reform. The differences in academic achievement and the directions of correlations between academic achievement and anxiety and depression among the medical students with different levels of anxiety and depression were also examined. Grade 1 students from graduate-entry program and grade 3 students from undergraduate-entry program in their first semester of the new curriculum were recruited to complete the Zung's Anxiety and Depression Scale twice to examine their levels of anxiety and depression. Their academic achievement ratings in the four blocks of the first semester of the new curriculum were collected. The results indicated that no significant correlation was found between academic achievement and global anxiety and depression. However, by dividing the medical students into low, moderate and high level anxiety or depression groups, those who had poorer academic achievement in the first learning block were more likely to have higher levels of depression in the first psychologic assessment. Among the medical students who were in the high anxiety level group in the first psychologic assessment, those who had more severe anxiety had poorer academic achievement in the fourth learning block. Among the medical students who were in the low anxiety level group in the second psychologic assessment, those who had more severe anxiety had better academic achievement in the fourth learning block. Among the medical students who were in the moderate anxiety level group in the second psychologic assessment, those who had more severe anxiety had poorer academic achievement in the second learning block. Among the medical students who were in the high depression level group in the second psychologic assessment, those who had more severe depression had poorer academic achievement in the fourth learning block. The results of this study indicate that there are both positive and negative correlations between academic achievement and anxiety and depression in medical students, regarding differing levels of severity of anxiety or depression. The results could represent a reference for teachers on the planning of teaching and assessment programs.

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Emotional disturbance leads to the deterioration of abilities in daily activities, especially those in the occupational domain. Academic achievement is an important dimension for students, so the effect of emotional disturbance on academic achievement is

an important subject in student coaching [1]. Many studies in the past have examined the correlations between emotional disturbance and academic achievement in children and adolescents. For example, several cross-sectional studies revealed that academic difficulties are more severe in children and adolescents with depressive disorders [2–4]. A longitudinal study among the children in Shanghai revealed that poor academic achievement could predict depressive symptoms 2 years later [5]. Another longitudinal study in Finland showed that depressive symptoms in childhood could predict poorer academic achievement in early adulthood [6]. However, studies among college students about correlations between academic achievement and levels of anxiety and depression are few and this issue needs more investigation [1]. Most college students are in the stages of late adolescence and early adulthood. In these stages, positive emotion is an important motivator, and they would naturally refuse to engage in something with unpleasant consequences [7]. Besides, academic achievement is obviously affected in depressed students [8] and learning difficulties also worsen emotional problems. So academic performance and personal emotional adaptations are two important dimensions of adaptive function in the college life period [9].

The field of medical knowledge is immense and it is particularly demanding in training programs for specialists. It is important for medical students to learn appropriate skills for coping and emotional management [10]. In past studies, it was found that poor psychologic health, including severe anxiety, depression, psychologic problems and overwork impaired learning ability in medical students and prevented medical students from getting sufficient knowledge, techniques and specialties in medical training programs [11,12]. For example, a longitudinal study showed that better preschool academic performance predicted lower levels of depression and anxiety. Also, lower levels of depression and anxiety predicted better academic achievements 8 months later [13].

Kaohsiung Medical University has implemented a new medical curriculum since September 2005. Different to the traditional organ system-based lectures delivered in auditorium in year 3 and year 4 students, this new curriculum is designed to integrate basic and clinical medical sciences, as well as clinical skills learning. In addition, the teaching methods of problem-based learning and e-learning are included, and an

objective structured clinical examination (OSCE) is carried out in order to evaluate the learning result. Kaohsiung Medical University has also shifted the clinical education of clerkship toward a program of full-time clinical attachment, which provides more opportunity for direct patient contact under supervision. Because there was a major change from the traditional lecture to the new format, in order to understand the psychologic adaptation of medical students, colleagues in bureau and counseling groups for students assessed the levels of anxiety and depression of the grade 1 students from the graduate-entry program and grade 3 students from the undergraduate-entry program in their first semester of the new curriculum. Everyone may experience anxiety or depression in daily life. However, different levels of depression and anxiety could affect personal functioning differently, and include both positive and negative effects. For example, the study of Yerkes and Dodson revealed that appropriate degrees of anxiety could promote performance in examinations but excessive degrees of anxiety impaired performance [14]. In other words, there is a U-shaped correlation between degrees of anxiety and performance in examinations. Our study aimed to examine whether there is a similar correlation between the levels of depression and anxiety and academic achievement in medical students. We examined the differences in academic achievement and the directions of correlations between academic achievement and anxiety and depression among the medical students experiencing curriculum reform with different levels of anxiety and depression.

MATERIALS AND METHODS

In the first semester of the 1st year program of the new curriculum, there were four learning blocks regarding different functional systems including the introductory first block, the second block about growth development and physiologic homeostasis, the third block about blood and cancer, and the fourth block about the cardiovascular system. A total of 147 grade 3 students from the undergraduate-entry program and 56 grade 1 students from the graduate-entry program were recruited. In order to determine the levels of depression and anxiety at different times, students completed the first questionnaire about depression and anxiety in the time period between the first and

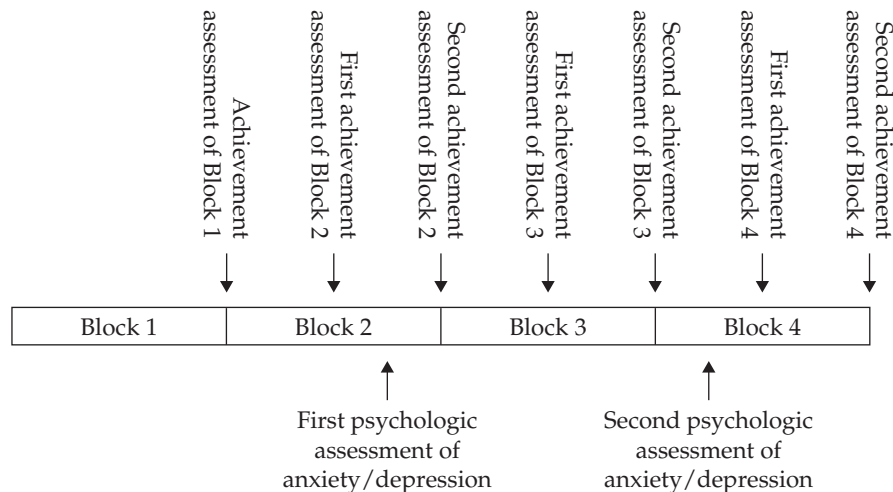


Figure. Time interval chart of the timings of psychologic assessments and achievement assessments of the four learning blocks.

second achievement assessments during the second learning block, and completed the second questionnaire in the time period between the third and fourth learning blocks. Regarding the time interval chart (Figure), the first psychologic assessment was done after the achievement assessment of Block 1, around the time of the achievement assessment of Block 2, but before the achievement assessment of Block 3. The second psychologic assessment was done after the achievement assessment of Block 2, around the time of the achievement assessment of Block 3 but before the achievement assessment of Block 4.

We used Zung's Anxiety and Depression Scale to evaluate the levels of depression and anxiety of the students [15]. There are a total of 40 items including 20 items on the level of anxiety, and 20 items on the level of depression. For every item, there are four grades including "never or seldom", "occasionally", "often" and "most of the time or always" for assessing the levels of anxiety and depression in the most recent 1 month. Higher scores indicate more severe anxiety and depression. This Chinese edition of the instrument has good validity and norms for college students in Taiwan [16], and may be used for screening for depression and anxiety. In addition, the raw scores can be transformed to a percentile ranking. For example, p90 and above in percentage indicates that the anxiety and depression index number of the respondents is in the most serious top 10 among the norm of university students. In this study, we defined a ranking of $\leq p30$ as mild anxiety/depression, $p30$ – $p70$ as moderate anxiety/depression, and $\geq p70$ as severe anxiety/depression.

Except for the first learning block, there were two achievement assessments in each learning block, and the average scores of the two achievement assessments represented the academic score of the block. We analyzed the raw scores for every learning block, which might be above 100 points in some blocks. Data were analyzed using SPSS version 10.0 (SPSS Inc., Chicago, IL, USA). First, we examined the correlation between the twice-measured raw scores for depression and anxiety levels and the academic scores for the four learning blocks. Then, analysis of variance was used to compare scores for the learning blocks among medical students with low, moderate and high levels of anxiety and depression. If there was a significant correlation, we further proceeded with the Fisher least significant difference test. After dividing the medical students into low, moderate and high levels of anxiety or depression groups, Pearson's correlation was used to examine the relationship between the raw scores of the levels of anxiety and depression and the academic scores for the learning blocks. A p value of less than 0.05 was considered statistically significant.

RESULTS

In the first psychologic assessment, we retrieved 196 copies including 140 copies from the grade 3 students in the undergraduate-entry program (returns ratio, 95.2%) and 56 copies from the grade 1 students in the graduate-entry program (returns ratio, 100%). In the second psychologic assessment, we retrieved 162

copies including 107 copies from the grade 3 students in the undergraduate-entry program (returns ratio, 72.8%) and 55 copies from the grade 1 students in the graduate-entry program (returns ratio, 98.2%).

The correlation between the raw scores of twice-administered psychologic assessments of anxiety and depression levels and academic scores for the learning blocks is shown in Table 1. The results indicate that before dividing the medical students into low, moderate and high levels of anxiety or depression groups, there was no significant correlation between any raw

scores for anxiety or depression and any academic scores for the learning blocks.

After dividing the medical students into low, moderate and high level groups, the academic scores for the learning blocks are shown in Tables 2 and 3. The results indicate that students who had low levels of depression in the first psychologic assessment had better academic achievement in the first block than those who had moderate and high levels of depression, $F(2, 191)=3.437, p<0.05$. However, in other blocks, there was no difference. There were no differences in academic achievement in any blocks among the different groups divided by the first assessment about anxiety and the second assessment about anxiety and depression.

After dividing the medical students into three groups with low, moderate and high levels of anxiety or depression, the correlations between the raw scores of twice-administered psychologic assessments for anxiety and depression and academic scores for the learning blocks among the three groups are shown in Tables 4 and 5. The results indicate that among the medical students with high levels of anxiety in the first psychologic assessment, those who had more

Table 1. Correlation between the raw scores of the two psychologic assessments of the levels of anxiety and depression and the academic scores of the four learning blocks

	First assessment		Second assessment	
	Anxiety	Depression	Anxiety	Depression
Scores				
Block 1	-0.013	-0.046	0.068	-0.029
Block 2	-0.107	-0.092	-0.037	-0.030
Block 3	-0.026	-0.063	-0.012	-0.091
Block 4	-0.058	-0.062	0.047	0.025

Table 2. Achievement scores in the four blocks among students with low, moderate or high levels of anxiety/depression in the first psychologic assessment

	Anxiety				F(2, 191)	Depression			
	Low Mean (SD)	Moderate Mean (SD)	High Mean (SD)	F(2, 191)		Low Mean (SD)	Moderate Mean (SD)	High Mean (SD)	F(2, 191)
Scores									
Block 1	78.4 (8.9)	78.1 (9.0)	78.6 (7.7)	0.069	81.2 (7.0)	76.9 (9.1)	78.1 (8.4)	3.437*	
Block 2	98.6 (10.7)	97.3 (11.8)	96.0 (10.9)	0.744	100.9 (12.0)	96.5 (10.0)	95.8 (11.5)	2.970	
Block 3	79.0 (11.4)	80.2 (11.8)	79.2 (10.7)	0.238	81.2 (12.2)	79.2 (10.3)	79.0 (11.6)	0.542	
Block 4	65.7 (12.1)	66.3 (11.3)	66.1 (10.7)	0.043	67.7 (11.8)	65.0 (11.2)	66.1 (11.1)	0.753	

* $p<0.05$. SD = standard deviation.

Table 3. Achievement scores in four blocks among students with low, moderate or high levels of anxiety/depression in the second psychologic assessment

	Anxiety				F(2, 191)	Depression			
	Low Mean (SD)	Moderate Mean (SD)	High Mean (SD)	F(2, 191)		Low Mean (SD)	Moderate Mean (SD)	High Mean (SD)	F(2, 191)
Scores									
Block 1	78.1 (8.2)	77.9 (8.7)	79.3 (8.3)	0.463	79.2 (8.8)	77.2 (8.2)	78.9 (8.3)	0.816	
Block 2	98.5 (9.5)	95.8 (12.1)	97.3 (12.0)	0.752	99.3 (11.1)	95.3 (11.4)	97.3 (11.4)	1.276	
Block 3	81.2 (8.5)	78.7 (11.8)	80.6 (12.1)	0.760	82.1 (10.0)	79.5 (9.6)	79.6 (12.3)	0.730	
Block 4	66.1 (10.1)	66.1 (11.5)	67.8 (11.3)	0.457	66.0 (12.0)	65.2 (9.8)	68.0 (11.2)	1.114	

severe anxiety had poorer academic achievement in the fourth learning block ($r = -0.252, p < 0.05$). However, among the students who had low or moderate levels of anxiety and any levels of depression in the first psychological assessment, there was no significant correlation between the scores of anxiety or depression and academic scores for any learning blocks (Table 4). Among the students with low levels of anxiety in the second psychological assessment, those who had higher levels of anxiety had better academic achievement in the fourth learning block ($r = 0.369, p < 0.05$). Among the medical students with moderate levels of anxiety in the second psychological assessment, those who had higher levels of anxiety had poorer academic achievement in the previous second learning block ($r = -0.298, p < 0.05$). Among the students with high levels of anxiety in the second psychological assessment, there was no significant correlation between the scores of anxiety and academic scores in any of the learning blocks. Among the students with high levels of depression in the second psychological assessment, those who had more severe depression had poorer academic achievement in the fourth learning block ($r = -0.234,$

$p < 0.05$). Among the students with low or moderate levels of depression in the second psychological assessment, there was no significant correlation between the scores of depression and academic scores in any of the learning blocks (Table 5).

DISCUSSION

Our study indicated that before dividing the medical students into groups of low, moderate and high levels of anxiety or depression, there was no significant correlation between academic achievement and global levels of anxiety and depression. However, after dividing the medical students into different levels of anxiety or depression, the students who had poorer academic achievement in the first learning block had higher levels of depression in the first psychological assessment. Among the students with high levels of anxiety in the first psychological assessment, those who had more severe anxiety had poorer academic achievement in the fourth learning block. Among the students with low levels of anxiety in the second psychological

Table 4. Correlations (r) between anxiety and depression in the first psychological assessment and academic scores of four learning blocks among students with low, moderate or high levels of anxiety/depression

	Anxiety			Depression		
	Low r	Moderate r	High r	Low r	Moderate r	High r
Scores						
Block 1	-0.119	-0.071	-0.057	0.182	0.041	0.044
Block 2	-0.010	-0.005	-0.116	0.032	0.092	0.062
Block 3	0.026	-0.016	-0.067	0.087	0.011	-0.053
Block 4	0.029	0.041	-0.252*	0.137	0.036	-0.154

* $p < 0.05$.

Table 5. Correlations (r) between anxiety and depression in the second psychological assessment and academic scores of four learning blocks among students with low, moderate or high levels of anxiety/depression

	Anxiety			Depression		
	Low r	Moderate r	High r	Low r	Moderate r	High r
Scores						
Block 1	0.204	-0.190	0.098	0.158	-0.107	-0.203
Block 2	0.238	-0.298*	0.009	0.260	-0.120	-0.084
Block 3	0.172	-0.221	0.019	0.173	-0.155	-0.115
Block 4	0.369*	-0.173	-0.097	0.251	-0.228	-0.234*

* $p < 0.05$.

assessment, those who had a higher level of anxiety showed better academic achievement in the fourth learning block. Among the students with moderate levels of anxiety in the second psychologic assessment, those who had poorer academic achievement in the second learning block had more severe anxiety. Among the medical students with high levels of depression in the second psychologic assessment, those who had more severe depression showed poorer academic achievement in the fourth learning block. As a result, though different levels of anxiety and depression do not always correlate with academic achievement in all learning blocks, there are positive and negative correlations between academic achievement in some learning blocks and levels of anxiety and depression among groups with different levels of anxiety or depression.

Our study indicated that among different levels of anxiety, there are different directions of correlation between levels of anxiety and academic achievement. In the past, several studies have investigated the learning effect under different levels of stress among people with different levels of anxiety. For example, a study showed that patients with high levels of anxiety had poor academic achievement under stressful instruction, but patients with low levels of anxiety had better academic achievement under stressful instruction [17]. Appropriate degrees of anxiety, especially concerning fear of failure, would self-reinforce the motivation system. Compared with people with the motivation of "hope of success", those with the motivation of "fear of failure" had better performance in tough tasks [18]. On the other hand, extreme anxiety interferes with attention [19], leads to hypervigilance and impairs the accuracy and objectivism of one's judgment [20]. A previous study also showed that extreme anxiety when facing an examination could impair children's cognitive function and further impair performance [21], though there was no clear definition or cut-off value by scale about the appropriate degree of anxiety. The assessor could assess the appropriateness of the anxiety by the usual performance on learning, daily activity, interpersonal interaction and the subjective feeling of the students. It is essential to help medical students to be aware of the levels and signs of anxiety in daily life. For example, all of the indicators of muscle tension, respiratory rate, blood pressure, sweating, gastrointestinal wriggle, saliva excretion and so on could indicate levels of anxiety

[22]. Then, excessive anxiety may be minimized and learning outcome promoted by relaxation skills or reverie in group or personal instruction, and by appropriate exercise and nutrition [23].

A medical student often has multiple stresses, including family problems, interpersonal problems, economic problems, career plans, and physical health. Medical lecture workload is notably heavy and poor academic performance would increase the pressure on medical students. Our study also indicated that those who had poorer performance in some learning blocks had higher levels of depression. On the other hand, factors that lead to cognitive function impairment including poor attention, poor memory and psychomotor retardation are common symptoms in depressed patients and may explain the poor academic achievement in severely depressed students [24]. However, another study indicated that academic achievement was directly affected by depressed mood, not completely through cognitive impairment [25]. Except for cognitive function impairment, depressed students have psychomotor retardation with presentations of fatigue, diminished interests, slowing of motion and difficulty in action [24]. As a result, students would have increased difficulties in attending classes and interpersonal interaction, and decreased motivation for learning. Past studies have shown the positive effects of antidepressants on cognitive impairment resulting from depression [24], so it is important for severely depressed students to receive medication therapy early and regain their learning ability.

There are some limitations in our study. First, the data of the norms of Zung's Anxiety and Depression Scale are outmoded and probably do not represent current conditions. Second, because we used a self-report scale, the results could have been confounded by the different motivations and situations of the students. Third, the return rate of the second questionnaire for psychologic assessment was low among students from the undergraduate-entry program so that we lost some data about the correlation between the levels of anxiety and depression and academic achievement. Last, the achievement of learning blocks is only one of the indicators of learning outcomes. Other indicators including learning accomplishment in group interaction, professional enthusiasm, altruistic motivation, academic research performance and clinical professional performance should be further investigated in the future.

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醫學生在接受課程整合教育時焦慮和憂鬱與學習成績之間相關性之探討

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本研究的目的是於：(1) 分析醫學生在接受課程整合教育時，其整體焦慮、憂鬱程度和學習成績的相關性；(2) 探討具有不同焦慮和憂鬱嚴重程度的醫學生是否具有學習成績高低的差異；和 (3) 不同焦慮和憂鬱嚴重程度區間之中，焦慮和憂鬱嚴重程度和學習成績高低的相關性其方向性為何。本研究以前後相隔一個半月時間，邀請高雄醫學大學醫學院中接受醫學課程整合教育第一學期的醫學系三年級和學士後醫學系一年級醫學生填寫兩次「曾氏心理健康量表 (Zung's Anxiety and Depression Scale)」以了解其焦慮和憂鬱的程度。另針對整合教育第一學期的四次學習單元做學習評量。研究結果發現，在區分成不同等級的焦慮/憂鬱前，整體焦慮或憂鬱程度和任何一個學習單元的學習成績皆未有顯著的關聯；但在區分為輕、中、重不同嚴重程度後顯示：在第一單元成績較不佳者，之後第一次施測的憂鬱程度較高；第一次施測時為重度焦慮者，焦慮程度越高，後來的第四單元成績越不佳；第二次施測時為輕度焦慮者，焦慮程度越高，後來的第四單元成績反而越佳；第二次施測時為中度焦慮者，先前的第二單元成績越不佳，後來的焦慮程度越高；第二次施測時為重度憂鬱者，憂鬱程度越高，後來的第四單元成績越不佳。由此可知，在不同焦慮或憂鬱嚴重程度者，焦慮或憂鬱程度和部份學習單元成績的關聯性有所不同，且存在正向或負向關聯性的差異。此研究結果可作為往後教師擬定教學方案及評量學生時之參考。

關鍵詞：學習成就，焦慮，憂鬱，醫學教育

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