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A latent Growth Curve Model of Academic Motivation and Academic Self-Efficacy of Shahid Chamran University Students

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In this study, a latent growth curve model of academic motivation and academic self-efficacy in Shahid Chamran University students was tested. The research method was developmental and of a longitudinal type. More precisely, the latent growth curve model was used to answer research questions. The statistical population of this study was all newly-arrived freshmen students of Shahid Chamran University in Ahvaz in the academic year of 2016-2017, who were 1988 students. Random sampling method was used to select newly-arrived students. From 13 departments of Shahid Chamran University of Ahvaz, 4 were randomly selected and all of their freshmen students filled out the questionnaires. The sample size of this study was 678 students. The instruments of this study include Academic Motivation Scale (AMS) and Academic Self-Efficacy Scale. Results showed that the mean score of intercept of academic motivation (at the beginning of university studies) was higher than the mean score of intercept of academic self-efficacy. Although the mean score of slopes of academic motivation and self-efficacy were decreased among the students during the three measurement times in university, the self-efficacy slope was not significant. Also, students who had high academic motivation at the beginning, had high scores in academic self-efficacy too, and those who had made progress in

their academic motivation during the one year study, have improved their academic self-efficacy too. Moreover, all the variances were significant. The results showed that the interpersonal variations support adding the predictor variables to the model. Also, the results indicated that gender was a significant predictor for academic motivation at the beginning of university studies. The results showed that the females' academic motivation, at the beginning of university, on the average, was more than the males', but the difference was not significant during the first year in university. Also, at the beginning, the academic performance was a significant predictor of academic self-efficacy. In other words, at the start of university studies, on the average, the high academic self-efficacy was associated with high academic performance, but the difference was not significant during the three measurements. Moreover, the non-linear model's goodness of fit statistic was better than the linear models.

Keywords: latent growth curve, academic motivation, academic self-efficacy, gender and academic performance

In the new era and in the struggle for competition among the societies, the countries are trying to consider the role of education, particularly higher education in the national development and promotion of knowledge and technology. Hence, the role of higher education in development is inevitable. In deed, university is one of the most valuable resources society possesses. In most developed and developing countries, university and academics meet the needs of the national development goals and problem solving. The main difference making a significant delineation between the situations of the developed and developing countries is their attitudes towards the scientific development and the valuation of this vital factor as well as the main basis for sustainable development. In general, higher education system has a central role in the national development process and in keeping the balance between the various dimensions of the country development. Systematic attention to this section plays a key role in providing facilities for future generations and the proper action for scientific development of the country. Many studies

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conducted in the field of the developed and newly developed countries' achievements have indicated how these countries move towards achieving a high level of development by explaining the goals and specifying their intentions in science and technology. Several factors may affect the successful development of countries, but undoubtedly, one of them is employing and taking advantage of motivated and self-efficient students (Sabeti, Homayonsepehr & Ahmadi, 2014).

The recognition of the educational development process during training in university also seems to be an essential need, because the development problems during this period may adversely affect students. Further, for many educational practitioners, the identification of the problems related to educational development process is very important. The results of the studies suggest that the motivation and self-efficacy are developmental variables, which change over time. For example, Wigfield and Eccles (2002) concluded that the level of childrens motivation will change as they grow up. Also, young children often seem to be sure about what they do. However, when they grow up, this self-confidence will fade (Lepper, Corpus and Lyengar, 2005). Further, in a longitudinal study using the latent growth curve analysis method, Taiga and Tobias (2016) showed that although at the initial level (intercept), students had a high internal and external motivation, their motivation diminished dramatically over a period of eight months. Entering the university is usually associated with many academic changes compared to the previous stages (Conley, Travers, Bryant, 2013). Additionally, in a longitudinal study of optimism, self-efficacy and suitable learning environment, Phan (2016) concluded that there is a positive relationship between a suitable learning environment and optimism as well as self-efficacy. In a research

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study, Nishimura and Sakurai (2017) studied the changes in the academic motivation of Japanese students according to self-determination theory. The results of the latent growth curve analysis revealed that during the high school education, the self-regulation (intrinsic motivation) decreases while other-regulation (control motivation) grows. Bouffard, Boileau and Vezeau (2001) also suggest that going to high school is associated with reduced interest and self-efficacy. Given that the academic motivation and self-efficacy are developmental processes, it is essential to study the process of changes in these two variables among university students.

Furthermore, it can be stated that gender and academic performance in childhood and adolescence can make huge differences in academic motivation and academic self-efficacy variables, before entering university and over time. Research has shown that there are differences in the students' motivation and self-efficacy in terms of gender and academic performance. For example, in the study of Lang and Hall (2005), the students with high motivation were significantly different in terms of academic performance when compared with low to moderately motivated students. Also, the results indicated a significant difference in successful and unsuccessful students in terms of motivational patterns and academic self-efficacy (McCoach and Siegle, 2001). In the study of gender differences, the research findings of Ratelle, Guay, Vallerand, Larose and Senecal (2007) indicated differences in academic motivation between males and females. Further, the results of the Yousefi, Ghassemi and Firouznia's research (2009) suggested that male students have greater motivation for effort, competition and self-efficacy than their female counterparts. However, the results of Ntoumaniis (2001) research revealed that they are both the same in terms of

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motivation. It is worth noting that the gender and the academic performance were added to the model as two predictor variables to see if they can predict the changes in the academic motivation and academic self-efficacy of the students over time.

Although it has been more than a decade that the latent growth curve has been used worldwide, this advanced method with high statistical capacity has not been used in our country so far. Accordingly, it is the first research conducted via this method. Given the above description, the research will examine gender differences and academic performance as predictors of academic motivation and academic self-efficacy model of Shahid Chamran University students, during several semesters. Since the research is longitudinal and studies the growth trend, we are not able to postulate hypotheses for it. So, in this research we have tried to answer the following questions:

1. How is the form of the academic motivation growth curve (linear or nonlinear) from the beginning of university to the end of the second year?
2. How is the academic motivation growth for each student?
3. How is the relationship between individual characteristics (gender and academic performance) before starting the university and the academic motivation growth?
4. How is the relationship between the initial level of the academic motivation (intercept) and the academic motivation growth (slope) over time?
5. How is the form of the academic self-efficacy growth curve (linear or nonlinear) from the beginning of university to the end of the second year?
6. How is the academic self-efficacy growth for each student?

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7. How is the relationship between individual characteristics (gender and academic performance) before starting the university and the academic self-efficacy growth?
8. How is the relationship between the initial level of the academic self-efficacy (intercept) and the academic self-efficacy growth (slope) over time?

Method

The method of the research is descriptive and longitudinal. More specifically, in order to answer the research questions, we used the latent growth curve model. The latent growth curve model is a particular kind of structural equation modeling (SEM), which studies a pattern of growth over time. This model can be used to test the theories about the causal relationships between different variables. This method is indeed a set of techniques used to test the theory-based hypotheses using correlation, covariance and even the mean differences between a series of dependent and independent variables with different forms and sizes (Giles, 1964, translated by Bahrami Ehsan, Sarrami Froshan, Bazargan, Farhadi, Bazazian and Parto, 2016). Also, the latent growth curve model is specifically able to show the exact changes of the growth. On the other hand, the method can well illustrate the growth changes and differences from the moment of the initial level (intercept) to the next level of the growth (slope) over time.

The statistical population of the research consisted of all new-entering students of Shahid Chamran University of Ahvaz in the academic year of 2016-2017, with a total of 1988 students. Two types of sampling method were used in the research: sampling to determine the validity and reliability of the instruments and for the testing of latent growth curve model. In order to determine the validity and reliability of the instruments, a total of 274

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students were selected randomly through a multistage method, where from 13 departments of Shahid Chamran University, 4 colleges were selected randomly. Then, all their new-entering students were isolated to complete the questionnaires and collect data. The sample size of the research was 678 students (273 boys and 405 girls). The sample size was large for some reasons: First, in the latent growth curve, the sample size should be large enough to support the model estimates and the statistical indices. The second reason is that the sample size should be large enough to have the statistical power to reject a weak model. The third reason is that in order to specify a more accurate confidence interval and higher statistical power, we need to have a large sample size. Finally, the sample should be large because of the missing data of the longitudinal method. Accordingly, the sample size should be large enough to compensate for the lost data. Ideally, it is better that the researcher not only selects the minimum specified sample size based on the consideration, but also selects a large sample to have enough power to test the statistical parameters and reach useful confidence intervals (Preacher, 2010).

Instruments

In the present research, the Academic Motivation Scale (AMS), and the Academic Self-Efficacy Scale were used to measure the variables.

Academic Motivation Scale

The Academic Motivation Scale has 28 items, including three domains: extrinsic motivation, intrinsic motivation and demotivation. This scale was developed by Vallerand, Blais, Briere and Pelletier (1989). The reliability coefficients of the scale were obtained in two ways: by test-retest method as .88 and

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by split-half method as .73 (Vallerand et al., 1989). In the research, the reliability of this scale was obtained using the Cronbach alpha and split-half methods, where the coefficients were .85 and .76, respectively. In addition, the validity of the scale was measured through confirmatory factor analysis. The results of the confirmatory factor analysis method indicated $\chi 2 = 2170.35$ with degrees of freedom df = 68, $\chi 2/df = 6.42$, Incremental Fit Index (IFI) IFI= .77, Goodness of Fit Index (GFI) GFI= .77, Comparative Fit Index (CFI) CFI= .77, Adjusted Goodness of Fit Index (AGFI) AGFI= .74, and Root Mean Square Error of Approximation (RMSEA) RMSEA= .08. All the items, except four of them, 1, 11, 12 and 22, had a significant effect on the academic motivation tests. Note that these four insignificant items were deleted from the main analysis.

Academic Self-Efficacy Scale

The Academic Self-Efficacy Scale was developed by Midgley et al. (2000) and translated into Persian by Shokrkon, Najjarian and Hashemi Sheikh Shabani (2005). The reliability of the scale was confirmed by those who developed it and the Cronbach alpha was reported to be .78. Middleton and Midgley (1997) found a correlation coefficient of .43 between the academic self-efficacy and the mastery goal-orientation. In this research, in order to determine the reliability of the scale, the Cronbach alpha and split-half methods were used where the coefficients were obtained as .86 and .56, respectively. Also, the reliability of the present scale was studied by confirmatory factor analysis method. The results of confirmatory factor analysis method showed $\chi^2 = 14.66$ with degrees of freedom df = 12, $\chi^2/df = 4.88$, Incremental Fit Index (IFI) IFI= .99, Goodness of Fit Index (GFI) GFI= .99, Comparative Fit Index (CFI) CFI= .99, Adjusted Goodness of Fit

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Index (AGFI) AGFI= .97 and Root Mean Square Error of Approximation (RMSEA) RMSEA= .076. All the items of this scale had a significant effect on the academic self-efficacy.

Academic Performance

In the present study, the diploma GPA of the participants during the years of 2016-2017 was used to measure the academic performance of the sample.

Results

The descriptive statistics of the variables are presented in Table 1.

Table 1

Means and Standard Deviations in Academic Motivation and Academic Self-Efficacy

Variable	First Measurement		Second Measurement		Third Measurement	
	M	SD	M	SD	M	SD
Academic Motivation	108.93	20.09	102.38	22.24	102.35	22.57
Academic Self-Efficacy	20.69	3.32	20.22	4.99	20.37	6.38

Note. M: Mean, SD: Standard Deviations

As shown in Table 1, the mean and (standard deviation) of the academic motivation variable was 108.93 (and 20.09) in the first measurement, 102.38 (and 22.24) in the second measurement, and 102.35 (and 22.57) in the third measurement. Also, the mean

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(and standard deviation) of the academic self-efficacy variable was 20.69 (and 3.32) in the first measurement, 20.22 (and 4.99) in the second measurement, and 20.37 (and 6.38) in the third measurement.

The descriptive statistics of male and female students' in terms of variables, in the three phases, are given in Table 2.

Table 2

Means and Standard Deviations

Variable		First Measurement		Second Measurement		Third Measurement	
		M	SD	M	SD	M	SD
Academic motivation	**Male**	103.86	21.69	98.50	22.57	97.42	22.46
	Female	112.35	18.17	105	21.66	105.68	22.05
Academic self-efficacy	**Male**	20.72	3.30	19.82	5.44	19.91	7.91
	Female	20.68	3.34	20.45	4.65	20.68	5.09

Note. M: Mean, SD: Standard Deviations

As reported in Table 2, the mean (and standard deviation) of the male students' in academic motivation has been 103.86 (and 21.69), 98.50 (and 22.57), and 97.42 (and 22.46) in the first, second, and third measurements, respectively. In academic self-efficacy variable for males, the mean (and standard deviation) has been 20.72 (and 3.30), 19.82 (and 5.44), and 19.91 (and 7.91) in the first,second, , and third measurements. Also, the mean (and standard deviation) of the academic motivation for females in the first measurement has been respectively 112.35 (and 18.17), 105 (and 21.66) in the second measurement, and 105.68 (and 22.05) in the third measurement. In academic self-efficacy variable for females in the first, second, and third measurement, the values

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have been 20.68 (and 3.34), 20.45 (and 4.65) and 20.68 (and 5.09), respectively.

Analysis of the Latent Growth Curve

In the first section, the indicators related to the baseline model will be studied.

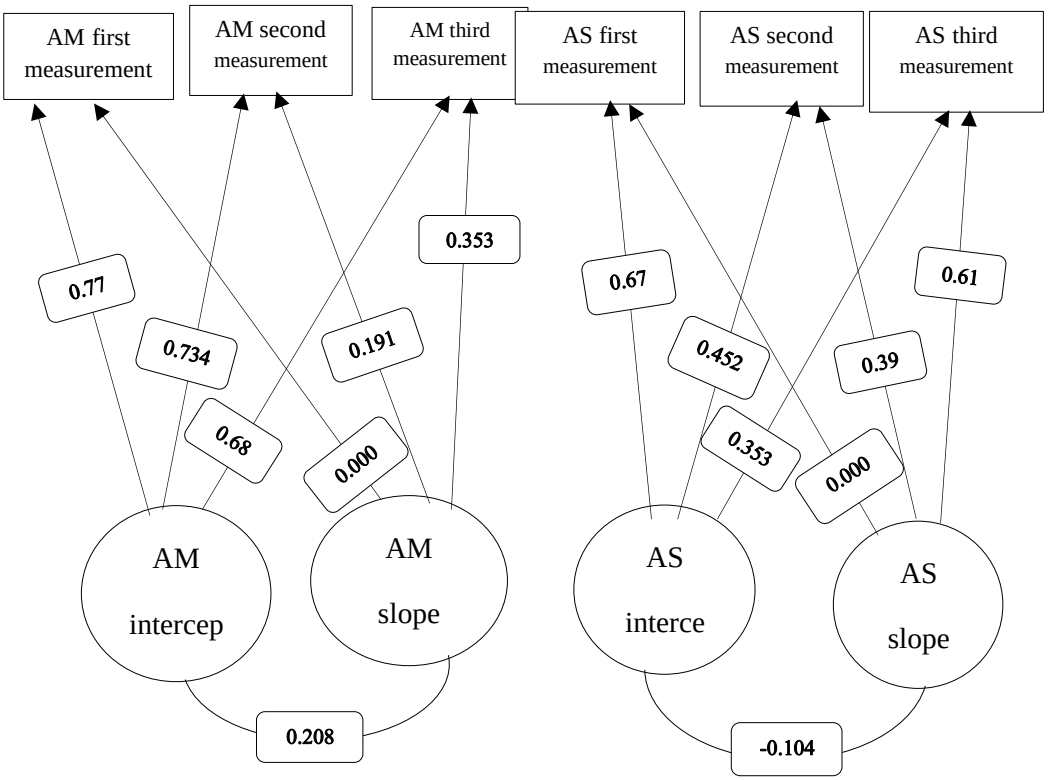

Figure 1. Baseline Model

Note. AM: Academic Motivation, AS: Academic Self-Efficacy

By studying the baseline model's goodness of fit statistics, we understand out whether the model needs to be modified or not. In the baseline model, the chi-squared (CMIN) was 151.766, the Root Mean Error of Approximation (RMSEA) was, .126, the

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Comparative Fit Index (CFI)) was, .864, and the Akaike Information Criterion (AIC) was is 179.766. Based on the baseline model's goodness of fit statistics, we observe that the model is not desirable, so we will make the proposed modifications and finally propose Model 1.

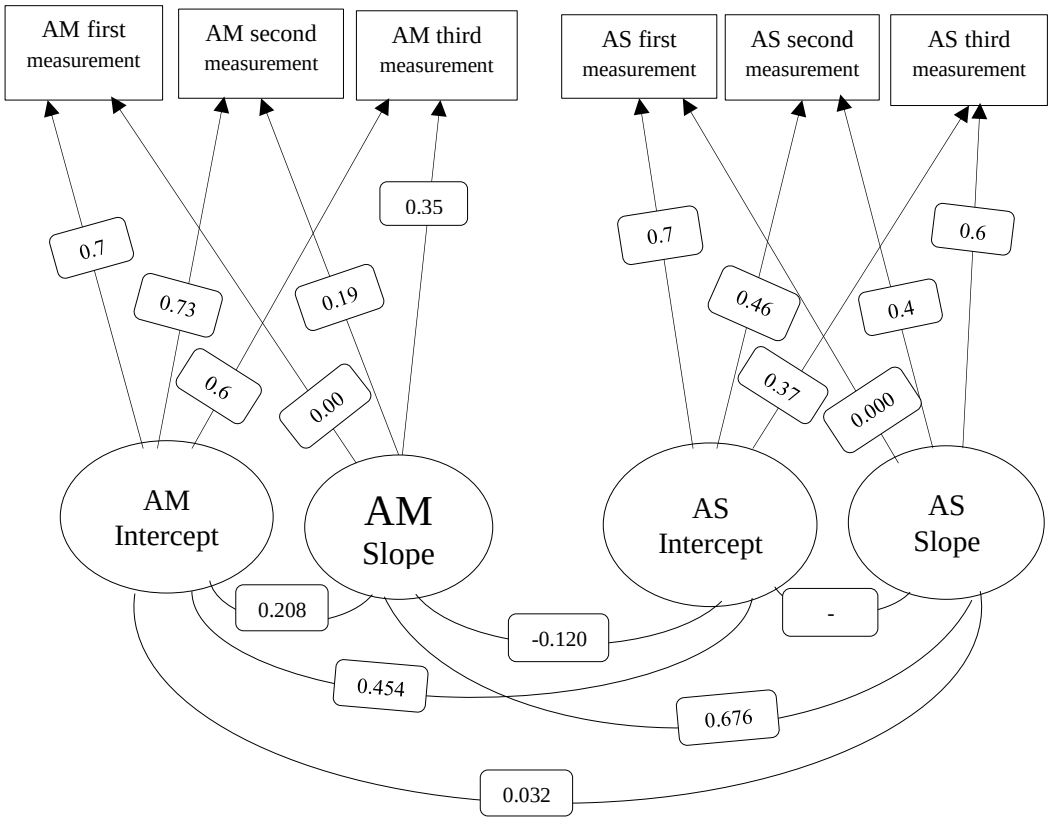

Figure 2. Model 1

Figure 2 demonstrates Model 1 while the covariances related to Model 1 are given in Table 3.

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Table 3

The Linear Model-Related Covariance without Predictor

Trajectories	Estimate	SE	CR	P
AM intercept ⟷ AM slope	.208	18.580	1.617	.149
AS intercept ⟷ AS slope	-.157	1.617	-.939	.352
AM intercept ⟷ AS intercept	.454	2.558	6.560	.0001
AM slope ⟷ AS slope	.676	5.010	4.520	.0001
AM intercept ⟷ AS slope	.032	4.838	.422	.288
AM slope ⟷ AS intercept	-.120	2.526	-.911	.362

Note. SE: Standard Error, CR: Critical Ratio, P: Values below zero

As shown in Table 3, of the six possible comparisons among the covariances, only two were significant. Thus, by studying the goodness of fit statistics of Model 1 we will realize whether the model needs to be modified or not. In Model 1, the chi squared (CMIN) was, 49.991, the Root Mean Error of Approximation (RMSEA) was, .082, the Comparative Fit Index (CFI) was, .960, and the Akaike Information Criterion (AIC) was is 85.991. In Model 1, we see that the model is not satisfactorily desirable, so we omit the insignificant covariances and propose Model 2. The figure related to Model 2 is shown further.

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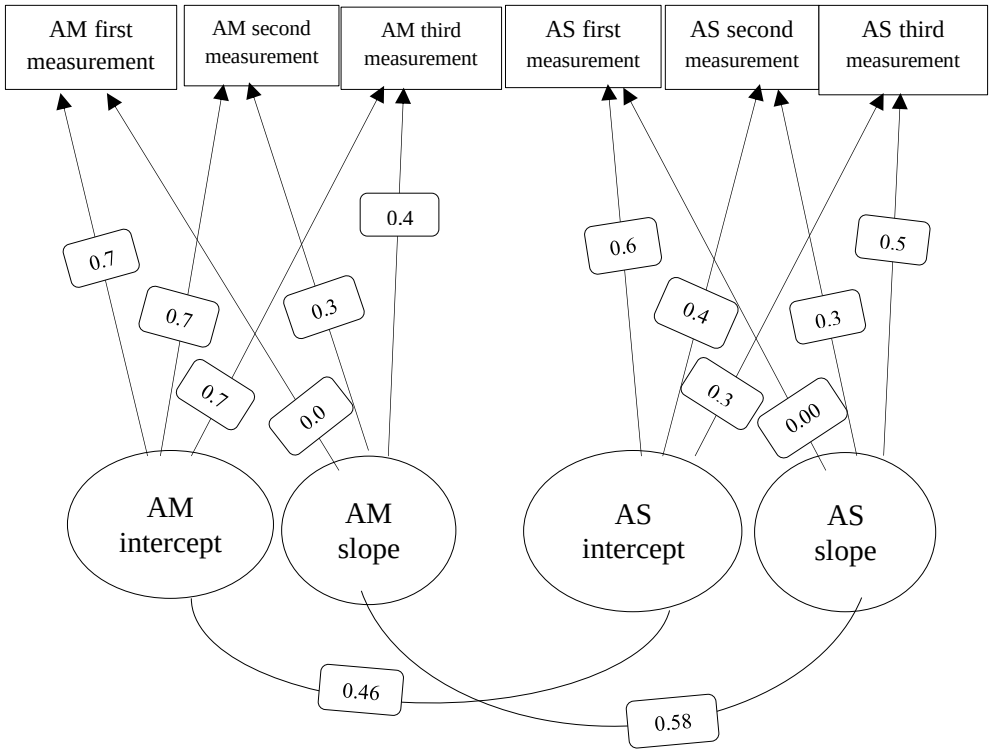

Figure 3. Model 2

Since, Model 1 was not desirable, we omitted the insignificant covariances where a covariance was considered between the intercept and the slope of the significant variables. In the model, the Chi Squared (CMIN) was 54.553, the Root Mean Error of Approximation (RMSEA) was, .069, the Comparative Fit Index (CFI) was, .959, and the Akaike Information Criterion (AIC) was 82.553.

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Table 4
Model 2 Means

Variable	Estimate	SE	CR	P
AM intercept	107.851	.757	142.403	.0001
AM slope	-6.580	.772	-8.520	.0001
AS intercept	20.662	.126	164.500	.0001
AS slope	-.424	-.245	-1.726	.084

Note. SE: Standard Error, CR: Critical Ratio, P: values below zero

Accordingly as can be seen, the mean scores of the intercept motivation at the beginning (107.851) are higher than the mean intercept self-efficacy (20.662). Although the mean motivation slopes (-6.580) and self-efficacy (-.424) decreased among the students during three semesters at university, the self-efficacy slope was not significant. Table 5 outlines, the parameters related to Model 2.

According to Table 5, looking at the covariances of Model 2, we observe that students who had high motivation at the beginning had also high scores in self-efficacy, and those who have made progress in their motivation during the three semesters, have improved their self-efficacy too. Note that, all the variances were significant. The results revealed that the interpersonal variations support adds the predictor variables to the model. The figure related to the model with predictor is presented further.

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Table 5

Parameters Related to Model 2

Variable	Estimate	SE	CR	P
Covariances				
AM intercept ⟷ AS intercept	16.173	2.264	7.145	.0001
AM slope ⟷ AS slope	21.767	4.417	4.928	.0001
Correlations				
AM intercept ⟷ AS intercept	.464			
AM slope ⟷ AS slope	.582			
Variations				
AM intercept	265.538	18.559	14.308	.0001
AM slope	97.858	21.735	4.502	.0001
AM intercept	4.572	.601	7.606	.0001
AM slope	14.272	2.422	5.894	.0001

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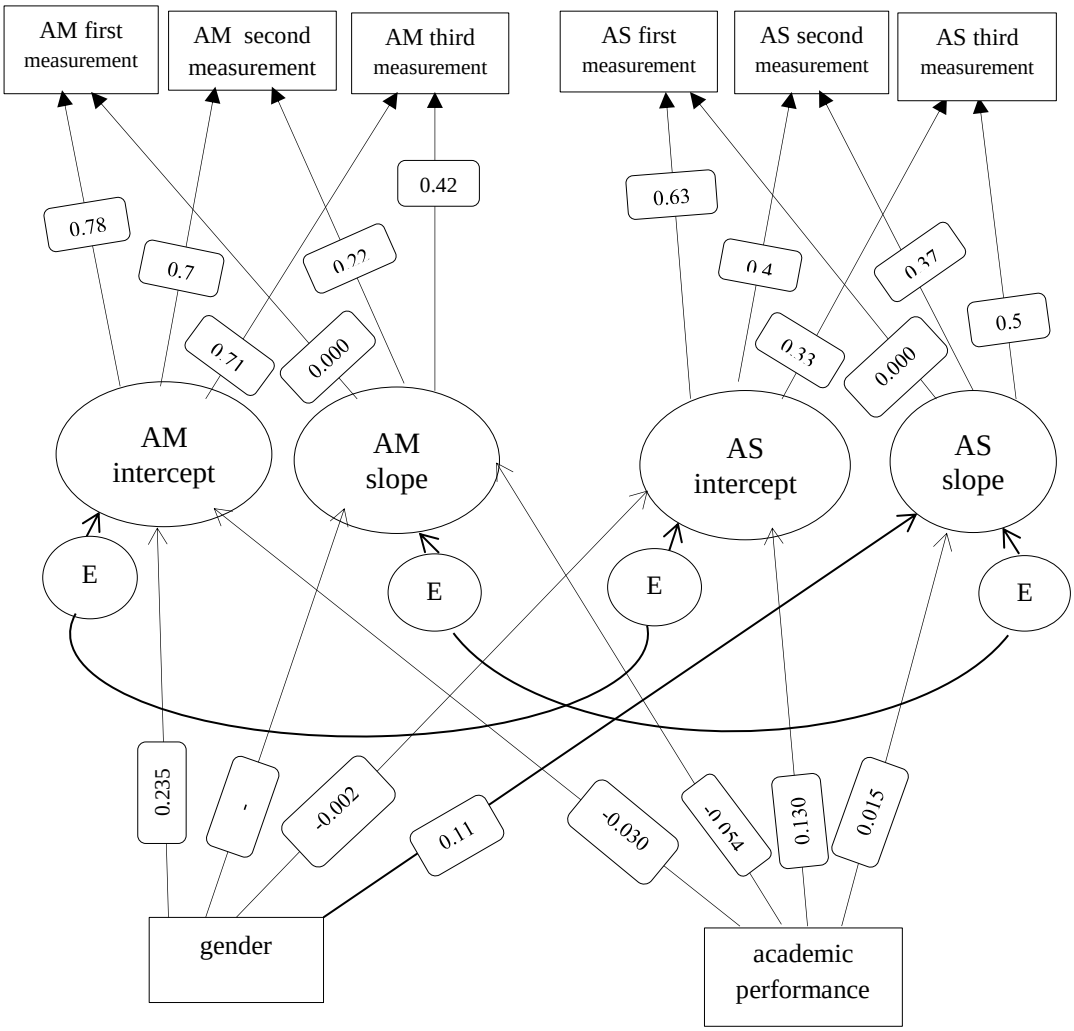

Figure 4. Model 3

Testing the model with the predictor indicated that the chi-squared (CMIN) was 167.852, the Root Mean Error of Approximation (RMSEA) was, .108, the Comparative Fit Index (CFI) was, .860, and the Akaike Information Criterion (AIC) was, 217.852. Accordingly, the model's goodness of fit statistic with predictor is weaker compared to model 2. The model parameters with the predictor are presented in Table 6.

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Table 6
Model 3 Parameters

Trajectories	Standardized Weight	Unstandardized Weight	SE	CR	P
Gender → AM intercept	.235	7.827	1.501	5.118	.0001
Gender → AM slope	-.013	-.254	1.629	-1.045	.296
Gender → AS intercept	-.002	-.007	.260	-.083	.934
Gender → AS slope	.116	.887	.547	1.160	.246
Performance → AM intercept	-.030	-.228	.348	-.877	.381
Performance → AM slope	-.054	-.242	.378	-.170	.865
Performance → AS intercept	.130	.127	.060	2.201	.028
Performance → AS slope	.015	.025	.127	-1.226	.220

Note. SE: Standard Error, CR: Critical Ratio, P: values below zero

The contents of Table 6 show that gender was a significant predictor for motivation at the beginning of university. Since the males were coded "1" and the females were coded "2', the revealed results showed that the females' academic motivation at the beginning of university was on average greater than the males, However, the difference was not significant during three semesters. Moreover, at the beginning of university, the academic performance was a significant predictor for academic self-efficacy. In other words, the results indicate that the females' self-efficacy at the beginning of university was on average greater than the males, but the difference was not significant during the

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three semesters. In the following figure, the Figure of Model 4 (non-linear) is displayed.

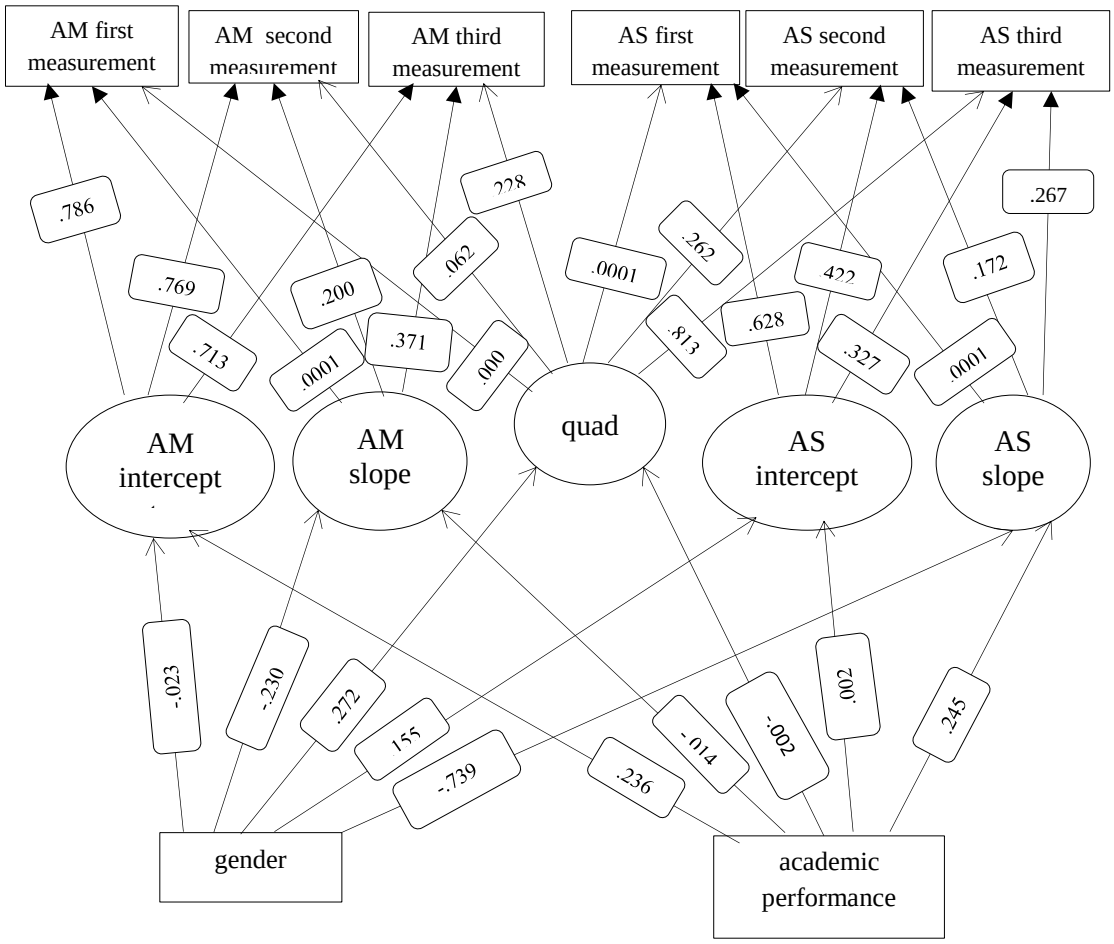

Figure 5. Model 4

The non-linear model test indicated that the chi-squared (CMIN) was 52.982, the Root Mean Error of Approximation (RMSEA) was, .065, the Comparative Fit Index (CFI) was, .962, and the Akaike Information Criterion (AIC) was 113.982. Accordingly,

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the non-linear model's goodness of fit statistic is better than that of other models (See Table 7).

Table 7

Fit Indices of Baseline Model, Model 1, Model 2, Model 3 and Model 4

Model	X^2	RMSEA	CFI	AIC
Baseline	151.766	.126	.864	179.766
Model 1	49.991	.082	.960	85.991
Model 2	54.553	.069	.959	82.553
Model 3	167.852	.108	.860	217.852
Model 4	52.982	.065	.962	113.982

Note. $\chi 2$: Chi squared, RMSEA= root mean error of approximation,CFI= comparative fit index, AIC = Akaike Information Criterion (smaller values are preferred)

Discussion

In general, five major findings were obtained from this study. First, from the beginning of the university until the end of the third semester, growth curve of the academic motivation, and the academic self-efficacy was nonlinear. Second, at the beginning of the university, gender was a significant predictor for the academic motivation, where the academic motivation of the females at the beginning of the university was on average greater than males. However, during the three measurements, the difference was not significant. Thirdly, the academic performance at the beginning of the study at the university was a significant predictor for the academic self-efficacy, though the difference was not significant during three semesters. Fourthly, the significant interpersonal differences in academic motivation and academic self-efficacy

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were observed among the students at the beginning of the university (intercept) and during the three subsequent measurement steps. Finally, the indicators of the nonlinear model goodness of fit were more appropriate than those of the linear model.

The result revealed that from the beginning of the university until the end of the third measurement, the growth curve of the academic motivation and self-efficacy was descending and nonlinear. This finding was consistent with the results of the Taiga and Tobias studies (2016). Entering the university is usually associated with academic changes and more challenges compared to the previous academic grades (Conley et al., 2013). Loss of the individual support loops (friends and family), stressful educational experiences, the difficulty of the lessons compared to other activities, and the dimensions of the student life all affect this issue. This, in turn, can reduce the academic motivation and self-efficacy of the students. In this regard, the findings are consistent with the results of Ratelle, et al. (2007). They suggested that at the beginning of the university, gender was a significant predictor for the academic motivation, and the academic motivation of the females was on average greater than that of males, though it was not a significant predictor for the academic self-efficacy. The difference was not significant for either variables during the three measurements. It seems that cultural problems and the gender stereotypes explain effect of gender on the differences at the beginning of university. Nevertheless, over time and during the three measurements steps, reduction of the cultural impacts and decline of the gender stereotypes have made this difference insignificant.

Furthermore, the results indicated that the academic performance at the beginning of the university was a significant

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predictor for the academic self-efficacy, though it was not a significant predictor for the academic motivation. Also, the difference was not significant either for the two variables during the three measurement steps. Many studies have suggested a significant difference between successful and unsuccessful students in terms of motivation patterns and academic self-efficacy (McCoach and Siegle, 2001). Clearly, there is a direct and mutual relationship between the academic performance and the academic self-efficacy. Mirheidari and Nistani (2015) noted that there is a positive and significant relationship between the self-efficacy beliefs and the academic achievement. Therefore, based on the significant relationship between the academic performance and the academic self-efficacy at the beginning of the university, we can explain the academic self-efficacy prediction by the academic performance. In explaining why these differences are insignificant during the three measurement steps, the previous academic performance (the diploma GPA) might be not an appropriate predictor for the changes in the academic motivation and the academic self-efficacy at university. Possibly, if the academic performance would be studied at the university, the result was different. Also, the results supported the significant interpersonal differences in the academic performance and the academic self-efficacy at the beginning of the university (intercept) and during the three measurement steps among the students. Explaining the result, it can be stated at the university, the students have more freedom of action and they face many social and educational demands and new academic and social relationships. This brings about a stressful situation for most students. They should be able to do their tasks like an independent and autonomous person. Accordingly, for adapting to the new academic condition, the students may follow different ways

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which can lead to increased interpersonal differences in their academic motivation and academic self-efficacy.

Although the results of the present study provide valuable information about the academic motivation and the self-efficacy of the students in a useful linear study and in an educational setting, some constraints in this study limit the generalizability of the results. Among these, we can refer to attrition of the sample due to the linearity of the study, non-intervention, only focusing on the students of Shahid Chamran University as a statistical sample, and using a self-reporting tool.

In order to generalize the results of the present study, interventional plans with the aim of increasing the academic motivation and self-efficacy among the students should be emphasized. Accordingly, it is suggested that the university practitioners and authorities use the strategies to increase the academic motivation and self-efficacy and recognize the detrimental factors for the students. Moreover, in order to prevent decline in of the students' academic motivation and self-efficacy, the psychologists and the consultants of educational centers can implement the programs in the form of workshops.

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