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A Relationship between Learning Beliefs/ Strategies and Academic Performance among Fukuoka Dental College Students

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Abstract

Background: With increasing student diversification and learning demands, education in accordance with the abilities and aptitudes of students is essential for higher education to fulfill its expected roles and appropriately respond to social expectations. However, at present, little information is available on classifying the abilities and characteristics of individual students.

Methods: Items related to learning beliefs and strategies were added to a questionnaire distributed at orientation to examine their relationships with academic performance.

Results: Learning beliefs and strategies based on "emphasis on thinking process" and the "monitoring strategy" demonstrated correlations with the learning achievements of dental students.

Conclusions: Among the scales for learning beliefs and strategies used in this study, "emphasis on thinking process" and the "monitoring strategy" appear to be useful for understanding the abilities and characteristics of students.

Keywords: Diversification; Learning beliefs; Learning strategies; Academic performance; Support for school attendance

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Introduction

The population of people aged 18 has continued to decrease from the peak of 2.05 million in 1992 to approximately 1.2 million in 2009, and this number is predicted to decrease furtherby 2021 [1]. However, the Standards for the Establishment of Universities outlined in 1991 resulted in an increase in the number of universities due to the easing of regulations in addition to the emergence of universities with lower than expected student enrollment and increased entrance rates.

Approximately 46% of private universities reported student enrollment below their admission quota in 2012 [2]. In addition, approximately half of the newly enrolled students had gained admission *via* the recommendation system or the Admissions Office examination, with no practical examinations on academic subjects, which led to diversification in the purpose, scholastic ability, and willingness of students.

At the Fukuoka Dental College, multiple examination

opportunities and entrance examination methods are provided to assist students with various qualities, abilities, and degrees of willingness with acceptance to the university, as listed in the admission policy. In addition, a comprehensive examination of scholastic ability is conducted at the beginning of the first year to identify the scholastic ability of individual students at university entrance. However, a student's scholastic ability at university entrance is not often comparable with their educational attainment level at graduation; thus, we believe that factors related to learning upon university entrance are associated with the educational attainment level at graduation.

To date, various factors related to learning have been examined in terms of educational psychology. Ichikawa et al. have described various ways of thinking in elucidating the mechanisms underlying learning methods (learning beliefs) [3]. Ueki has also reported that learning beliefs can promote or suppress conscious ingenuity to improve learning (learning strategies) [4].

The present study aimed to determine whether learning beliefs and strategies influence new learning upon university entrance and learning achievements upon graduation. Therefore, items related to learning beliefs and strategies were added to the student orientation questionnaire to examine the relationship between the questionnaire responses and learning achievements at the university.

Materials and Methods

Target

In the beginning, the survey was explained orally and *via* a document, and after checking the consent, it was conducted.

When it is used for any purpose other than study support, it becomes anonymous to connect all data and process and use it so that an individual cannot specify.

You can refuse use of data.

Opt-out is possible, even if it once agrees.

After explaining the above mentioned contents to a student, was put into effect. All the target students' consent was checked orally. Thus, this research was done by having adopted the principle of Declaration of Helsinki, and was performed by obtaining the approval of Ethical Review Board, Fukuoka Dental College.

The questionnaire was distributed to all students at orientation in April 2017. Of the 527 questionnaires distributed, 508 (96.4%) were appropriately completed by the students and included in the analysis. The respondents comprised 102 second-year students (95.3%), 97 third-year students (98.0%), 113 fourth-year students (95.8%), 85 fifth-year students (95.5%), and 111 sixth-year students (97.4%). Among the respondents, we selected 445 students who were enrolled at Fukuoka Dental College between 2012 and 2016, who were currently registered as second- to sixth-year students, and who had no missing data required for their examination as subjects (79 enrolled in 2012, 91 in 2013, 88 in 2014, 96 in 2015, and 91 in 2016). Of these students, 28 who had repeated a year were excluded from the analysis.

Analysis of learning beliefs and strategies

The newly created "questionnaire regarding learning" was completed by the students upon assignment of a student ID number. The data were compared, and the aggregate results of the questionnaire and data on academic performance and lecture attendance were analyzed. The questionnaire comprised 36 items: 24 to measure learning beliefs using the psychological scale described by Ichikawa 3 and 12 to measure learning strategies using the psychological scale described by Ueki [4]. The questionnaire items were randomly arranged using a table of random numbers and are shown in **Table 1**. The items used to measure learning beliefs fell into four categories containing six items each: "systemic understanding orientation," "emphasis on thinking process," "flexibility regarding failure," and "strategy orientation." Three items were set as reversal items in each category. The items used to measure learning strategies fell into two categories containing six items each: "refinement strategy" and "monitoring strategy." Two items under "refinement strategy" and one item under "monitoring strategy" were set as reversal items. Learning beliefs were measured using a five-point scale: "definitely not applicable," "not applicable," "neither," "applicable," and "completely applicable," whereas learning strategies were measured using a seven-point scale: "never do so," "seldom do so," "tend not to do so," "neither," "tend to do so," "often do so," and "always do so."

Data

The following data for current second- to sixth-year students who enrolled at the university between 2012 and 2016 were used.

- Score in the total comprehensive examination conducted at the beginning of the first year
- to test scholastic ability
- Grade point average (GPA) in each academic year
- Attendance rate from university entrance to April of the current academic year

Upon linking these data to the questionnaire results, the student ID numbers were deleted to anonymize the data.

Statistical processing

To examine the relationship between scholastic ability at university entrance and learning achievements or the attendance rate after entry, Spearman's rank correlation coefficients between the total score in the comprehensive examination conducted at the beginning of the first year to test scholastic ability and the GPA for each academic year or the attendance rate up to the current academic year were calculated. Next, to examine the relationship between learning beliefs and strategies and learning achievements or the attendance rate after entry, Spearman's rank correlation coefficients between the six-scale questionnaire results on learning beliefs and strategies and the GPA for each academic year or the attendance rate up to the current academic year were calculated.

Table 1: Question items for "Questionnaire Regarding Learning"

Question items to measure learning beliefs (Ichikawa, 1998) *is a reversal item indicating a reverse trend to the meaning represented by the scale.	
Semantic understanding orientation	You make a point of accumulating information by understanding it rather than learning by rote.
	You attempt to grasp the relationship between things that you have learned.
	You study by organizing information using diagrams, tables, etc.
	*In mathematics, you first learn formulas well, and then apply them to solve problems.
	*You get used to problems having the same pattern by repeating them many times.
	*You often memorize answers without thinking too much about how you got the answer.
Emphasis on thinking process	You believe that it is important to not only find the answer to the problem but also have the correct way of thinking.
	Even after having solved a problem, you may look for alternative solutions.
	Regarding problems that you could not solve in a test, you want to know the solution even after the test is complete.
	*You believe that it is fine to not understand how you obtained the answer, as long as the answer is correct.
	*In tests, you are more interested in whether or not the answer is correct than in the way of thinking en route to getting the answer.
	*Thinking about a solution in various ways on your own is too much work.
Flexibility regarding failure	When things do not go as expected, you attempt to determine the cause.
	You believe that it is fine to gradually perfect things while experiencing repeated failures.
	When things do not go as expected, you tend to work hard to somehow figure it out.
	*You feel embarrassed when you make a mistake.
	*You immediately lose your motivation when you feel that things do not appear to be going well.
	*You tend to immediately feel disappointed if you fail.
Strategy orientation	You like to devise ways of studying.
	You are interested in how successful people study.
	You attempt to reevaluate the method rather than the quantity of study when the results of a test are poor.
	*You believe that the end results will not change too much even if you change your study methods.
	*You find it troublesome to change your learning method.
	*To improve performance, you feel you must strive to study more.
Question items to measure learning strategies (Ueki, 2002) *is a reversal item indicating a reverse trend to the meaning represented by the scale.	
Monitoring strategy	You attempt to question whether you could understand what your teacher said during and after class.
	When you solve a problem but cannot understand it, you attempt to think about where you got stuck.
	You ask yourself questions to confirm what you have learned.
	When reading, you proceed to read while stopping once in a while to confirm the contents which you have read.
	When you read something, you read it while thinking about to what degree you understand it.
	*When you read textbooks and reference books, you do not know whether you understand the contents.
Refinement strategy	*When you learn study contents, you memorize the terms for which you do not understand the meaning by repeating them in your head.
	When you read something, you attempt to make a connection between what you are reading and what you know.
	If you come across any difficult terms while studying, you comprehend them by replacing them with terms that you understand.
	*If you come across something you do not understand while studying, you memorize it as is.
	If you come across something you cannot memorize while studying, you memorize it by coming up with a way that allows you to easily memorize it.
	Before memorizing study contents, you attempt to memorize them by transforming them into a form that easily stays in your head.

Results

Table 2 shows the average values of the scores in the comprehensive examination to test scholastic ability by entry year, GPA, and attendance rate for each academic year up to the current academic year, along with the questionnaire responses.

Relationship between scholastic ability at university entrance and the attendance rate

A positive correlation was observed between the total score in the comprehensive examination to test scholastic ability and the attendance rate of students enrolled in 2012 and 2013 (2012:

ρs=0.321, p<0.01; 2013: ρs=0.377, p<0.01) but no significant correlations of students enrolled from 2014 to 2016 .

Relationship between learning beliefs and strategies and the attendance rate

Among students enrolled in 2014-2016 **(Table 3A)**. "flexibility regarding failure" was negatively correlated with the attendance rate (ρs=−0.243, p<0.05). Among students enrolled in 2013, "emphasis on thinking process" and "monitoring strategy" were positively correlated with the attendance rate (emphasis on thinking process: ρs=0.268, p<0.05; monitoring strategy: ρs=0.405, p<0.01). Among students enrolled in 2016, "strategy orientation," "monitoring strategy," and "refinement strategy" were positively correlated with the attendance rate (strategy orientation: ρs=0.346, p<0.01; monitoring strategy: ρs=0.330, p<0.01; refinement strategy: ρs=0.403, p<0.01). Among students enrolled in 2014 and 2015, no significant correlations with the attendance rate were observed **(Table 3B).**

Relationship between scholastic ability at university entrance and learning achievements up to the current academic year

Among students enrolled in 2012, scholastic ability at university entrance showed a high positive correlation with first-year GPA (ρs=0.713, p<0.01) and positive correlations with second-to fifth-year GPA (second-year GPA: ρs=0.474, p<0.01; third-year GPA: ρs=0.393, p<0.01; fourth-year GPA: ρs=0.419, p<0.01; fifth-year GPA: ρs=0.312, p<0.05). Among students enrolled in 2013, scholastic ability at university entrance showed positive correlations with first- to fourth-year GPA (first-year GPA: ρs=0.644, p<0.01; second-year GPA: ρs=0.482, p<0.01; third-year GPA: ρs=0.426, p<0.01; fourth-year GPA: ρs=0.365, p<0.01). Among students enrolled in 2014, scholastic ability at university entrance showed high positive correlations with first- to third-year GPA (first-year GPA: ρs=0.723, p<0.01; second-year GPA: ρs=0.644, p<0.01; third-year GPA: ρs=0.542, p<0.01). Among students enrolled in 2015, scholastic ability at university entrance showed positive correlations with first-and second-year GPA (first-year GPA: ρs=0.558, p<0.01; second-year GPA: ρs=0.565, p<0.01). Among students enrolled in 2016, scholastic ability at university entrance showed a positive correlation with first-year GPA (ρs=0.576, p<0.01) **(Table 4).**

Relationship between learning beliefs and strategies and learning achievements up to the current academic year

Students enrolled in 2012 (relationship with first-to fifth-year GPA): Positive correlations were observed between "semantic understanding orientation" and first-to fourth-year GPA (first-year GPA: ρs=0.345, p<0.01; second-year GPA: ρs=0.229, p<0.05; third-year GPA: ρs=0.273, p<0.05; fourth-year GPA: ρs=0.234, p<0.05), as well as between "emphasis on thinking process" and first-to third-and fifth-year GPA (first-year GPA: ρs=0.327, p<0.01; second-year GPA: ρs=0.222, p<0.05; third-year GPA: ρs=0.225, p<0.05; fifth: ρs=0.251, p<0.05). No significant correlation was observed between "flexibility regarding failure" and first-to fifth-year GPA. Positive correlations were observed between "strategy orientation" and third-year GPA (ρs=0.241, p<0.05), between "monitoring strategy" and first-to fifth-year GPA (first-year GPA: ρs=0.381, p<0.01; second-year GPA: ρs=0.333, p<0.01; third-year GPA: ρs=0.333, p<0.01; fourth-year GPA: ρs=0.346, p<0.01; fifth-year GPA: ρs=0.376, p<0.01), and between "refinement strategy" and first- and fourth-year GPA (first-year GPA: ρs=0.305, p<0.01; fourth-year GPA: ρs=0.234, p<0.05) **(Table 5A)**.

Table 2: Averages of the results of the comprehensive examination to test scholastic ability by entry year, GPA, and the attendance rate for each academic year up to the current academic year, along with the questionnaire results

Entry year	No. of students		Total score of the comprehensive examination to test scholastic ability	1st-year GPA	2nd-year GPA	3rd-year GPA	4th-year GPA	5th-year GPA	Attendance rate	Semantic understanding orientation	Emphasis on thinking process	Flexibility regarding failure	Strategy orientation	Monitoring strategy	Refinement strategy
2012	79	Average	280.8	3.06	2.85	2.98	2.95	3.39	93.7	19.5	20.5	19.5	19.8	27.5	28.1
		Standard deviation	80.5	0.60	0.75	0.60	0.56	0.43	5.0	2.7	3.1	2.7	2.8	4.8	4.2
2013	91	Average	290.4	3.12	2.71	3.18	3.17		93.6	19.1	19.8	19.3	20	27.6	27.6
		Standard deviation	73.6	0.60	0.77	0.58	0.55		6.9	2.5	2.7	2.3	2.7	4.9	3.6
2014	88	Average	322.5	3.22	2.98	3.20			96.7	19.1	20.4	19.7	19.4	27.1	26.9
		Standard deviation	69.3	0.52	0.63	0.49			4.3	2.6	2.9	2.8	2.6	4.4	4.1
2015	96	Average	305.4	3.29	3.00				96.7	18.9	19.2	19.4	19.8	27.5	27
		Standard deviation	69.5	0.48	0.62				4.7	2.4	3.3	3	3.2	5.2	3.6
2016	91	Average	287.2	3.18					95.4	18.6	19.4	19.5	19.4	27.8	27
		Standard deviation	59.4	0.52					5.6	2.1	3.2	2.9	2.8	5.2	3.5

Table 3A: Correlation between the total score in the comprehensive examination to test scholastic ability and the attendance rate.

Entry year	2012	2013	2014	2015	2016
Correlation coefficient	0.321**	0.377**	0.112	0.093	0.169
Significance probability (two-sided)	0.004	0.000	0.298	0.368	0.109

** Correlation coefficient is significant at the 1% level (two-sided).
* Correlation coefficient is significant at the 5% level (two-sided).

Table 3B: Correlation between four-point scale for learning beliefs/two-point scale for learning strategies and attendance rate.

		Entry year	2012	2013	2014	2015	2016
Learning beliefs	Semantic understanding orientation	Correlation coefficient	−0.015	0.128	−0.136	0.100	0.085
		Significance probability (two-sided)	0.899	0.227	0.206	0.333	0.422
	Emphasis on thinking process	Correlation coefficient	−0.052	0.268*	−0.019	0.131	0.186
		Significance probability (two-sided)	0.648	0.010	0.86	0.203	0.078
	Flexibility regarding failure	Correlation coefficient	−0.243*	0.048	−0.063	−0.013	0.116
		Significance probability (two-sided)	0.031	0.655	0.558	0.898	0.273
	Strategy orientation	Correlation coefficient	0.066	0.071	0.077	0.038	0.346**
		Significance probability (two-sided)	0.565	0.503	0.477	0.713	0.001
Learning strategies	Monitoring strategy	Correlation coefficient	0.047	0.405**	0.099	0.179	0.330**
		Significance probability (two-sided)	0.678	0.000	0.358	0.081	0.001
	Refinement strategy	Correlation coefficient	0.086	0.194	−0.035	0.077	0.403**
		Significance probability (two-sided)	0.452	0.065	0.749	0.457	0.000

** Correlation coefficient is significant at the 1% level (two-sided).
* Correlation coefficient is significant at the 5% level (two-sided).

Table 4: Correlation between the total score in the comprehensive examination to test scholastic ability and GPA up to the current academic year.

Entry year		1st-year GPA	2nd-year GPA	3rd-year GPA	4th-year GPA	5th-year GPA
2012	Correlation coefficient	0.713**	0.474**	0.393**	0.419**	0.312*
	Significance probability (two-sided)	0.000	0.000	0.000	0.000	0.011
2013	Correlation coefficient	0.644**	0.482**	0.426**	0.365**	
	Significance probability (two-sided)	0.000	0.000	0.000	0.002	
2014	Correlation coefficient	0.723**	0.644**	0.542**		
	Significance probability (two-sided)	0.000	0.000	0.000		
2015	Correlation coefficient	0.558**	0.565**			
	Significance probability (two-sided)	0.000	0.000			
2016	Correlation coefficient	0.576**				
	Significance probability (two-sided)	0.000				

** Correlation coefficient is significant at the 1% level (two-sided).
* Correlation coefficient is significant at the 5% level (two-sided).

Students enrolled in 2013 (relationship with first- to fourth-year GPA): Positive correlations were observed between "semantic understanding orientation" and first-year GPA ($\rho s=0.255$, $p<0.05$), between "emphasis on thinking process" and firstto fourth-year GPA (first-year GPA: $\rho s=0.384$, $p<0.01$; second-year GPA: $\rho s=0.339$, $p<0.01$; third-year GPA: $\rho s=0.341$, $p<0.01$; fourth-year GPA: $\rho s=0.314$, $p<0.01$), between "flexibility regarding failure" and first-year GPA ($\rho s=0.216$, $p<0.05$), between "monitoring strategy" and first-to fourth-year GPA (first-year GPA: $\rho s=0.523$, $p<0.01$; second-year GPA: $\rho s=0.500$, $p<0.01$; third-year GPA: $\rho s=0.514$, $p<0.01$; fourth-year GPA: $\rho s=0.387$, $p<0.01$), and between "refinement strategy" and first-to third-year GPA (first-year GPA: $\rho s=0.354$, $p<0.01$; second-year GPA: $\rho s=0.288$, $p<0.01$; third-year GPA: $\rho s=0.278$, $p<0.05$). No significant correlation was observed between "strategy orientation" and first-to fourth-year GPA **(Table 5B).**

Students enrolled in 2014 (relationship with first- to third-year GPA): Positive correlations were observed between "semantic understanding orientation" and first-to third-year GPA (first-year GPA: $\rho s=0.251$, $p<0.05$; second-year GPA: $\rho s=0.317$, $p<0.01$; third-year GPA: $\rho s=0.299$, $p<0.01$), between "emphasis on thinking process" and first-to third-year GPA (first-year GPA: $\rho s=0.360$, $p<0.01$; second-year GPA: $\rho s=0.339$, $p<0.01$; third-year GPA: $\rho s=0.309$, $p<0.01$), between "monitoring strategy" and first-to third-year GPA (first-year GPA: $\rho s=0.372$, $p<0.01$; second-year GPA: $\rho s=0.283$, $p<0.01$; third-year GPA: $\rho s=0.274$, $p<0.05$), and between "refinement strategy" and first-to third-year GPA (first-year GPA: $\rho s=0.295$, $p<0.01$; second-year GPA: $\rho s=0.264$, $p<0.05$; third-year GPA: $\rho s=0.263$, $p<0.05$). "Flexibility regarding failure" and "strategy orientation" showed no significant correlation with first-to third-year GPA **(Tables 5C)**.

Students enrolled in 2015 (relationship with first- and second-year GPA): Positive correlations with first-year GPA were observed for the following items: semantic understanding orientation ($\rho s=0.330$, $p<0.01$), emphasis on thinking process

Table 5A: Correlation between the total score in the comprehensive examination to test scholastic ability and GPA up to the current academic year 2012.

			1st-year GPA	2nd-year GPA	3rd-year GPA	4th-year GPA	5th-year GPA
Learning beliefs	Semantic understanding orientation	Correlation coefficient	0.345**	0.229*	0.273*	0.256*	0.180
		Significance probability (two-sided)	0.002	0.042	0.015	0.029	0.150
	Emphasis on thinking process	Correlation coefficient	0.327**	0.222*	0.225*	0.224	0.251*
		Significance probability (two-sided)	0.003	0.050	0.046	0.057	0.044
	Flexibility regarding failure	Correlation coefficient	0.029	−0.083	−0.019	−0.133	−0.035
		Significance probability (two-sided)	0.803	0.468	0.865	0.260	0.780
	Strategy orientation	Correlation coefficient	0.167	0.187	0.241*	0.177	0.150
		Significance probability (two-sided)	0.142	0.098	0.032	0.135	0.233
Learning strategies	Monitoring strategy	Correlation coefficient	0.381**	0.333**	0.333**	0.346**	0.376**
		Significance probability (two-sided)	0.001	0.003	0.003	0.003	0.002
	Refinement strategy	Correlation coefficient	0.305**	0.219	0.202	0.234*	0.238
		Significance probability (two-sided)	0.006	0.052	0.074	0.047	0.056

** Correlation coefficient is significant at the 1% level (two-sided).
* Correlation coefficient is significant at the 5% level (two-sided).

Table 5B: Correlation between four-point scale for learning beliefs/two-point scale for learning strategies and GPA for each academic year in students enrolled in 2013.

			1st-year GPA	2nd-year GPA	3rd-year GPA	4th-year GPA
Learning beliefs	Semantic understanding orientation	Correlation coefficient	0.255*	0.200	0.142	0.160
		Significance probability (two-sided)	0.015	0.059	0.193	0.185
	Emphasis on thinking process	Correlation coefficient	0.384**	0.339**	0.341**	0.314**
		Significance probability (two-sided)	0.000	0.001	0.001	0.008
	Flexibility regarding failure	Correlation coefficient	0.216*	0.189	0.138	0.052
		Significance probability (two-sided)	0.040	0.075	0.209	0.667
	Strategy orientation	Correlation coefficient	0.163	0.146	0.135	-0.015
		Significance probability (two-sided)	0.123	0.171	0.217	0.903
Learning strategies	Monitoring strategy	Correlation coefficient	0.523**	0.500**	0.514**	0.387**
		Significance probability (two-sided)	0.000	0.000	0.000	0.001
	Refinement strategy	Correlation coefficient	0.354**	0.288**	0.278*	0.099
		Significance probability (two-sided)	0.001	0.006	0.010	0.413

** Correlation coefficient is significant at the 1% level (two-sided).
* Correlation coefficient is significant at the 5% level (two-sided).

(ρs=0.312, p<0.01), strategy orientation (ρs=0.245, p<0.05), monitoring strategy (ρs=0.419, p<0.01), and refinement strategy (ρs=0.386, p<0.01). Positive correlations to second-year GPA were observed for the following items: semantic understanding orientation (ρs=0.294, p<0.01), emphasis on thinking process (ρs=0.309, p<0.01), monitoring strategy (ρs=0.325, p<0.01), and refinement strategy (ρs=0.296, p<0.01). No significant correlation was observed between "flexibility regarding failure" and first- or second-year GPA **(Tables 5D)**.

Students enrolled in 2016 (relationship with first-year GPA): A positive correlation with first-year GPA was observed for the following items: semantic understanding orientation (ρs=0.314, p<0.01), emphasis on thinking process (ρs=0.358, p<0.01), flexibility regarding failure (ρs=0.244, p<0.05), strategy orientation (ρs=0.330, p<0.01), monitoring strategy (ρs = 0.503, p<0.01), and refinement strategy (ρs=0.485, p<0.01) **(Table 5E).**

Discussion

A survey on learning beliefs and strategies was conducted to examine the relationship between student responses and academic performance at the university. The comprehensive examination to test scholastic ability conducted at the beginning of the first year at the Fukuoka Dental College comprised three subject areas and five subjects: English, mathematics, and science (physics, chemistry, and biology), which are evaluated at the senior high school level. The final results are used to characterize the scholastic abilities of the students at university entrance. Current expectations for higher education necessitate clarification of academic achievements, development of teaching methods and plans using a syllabus, and stringent achievement evaluation, thus raising the need for achievement management measures using GPA [5].

The GPA system introduced at this university in 2014 had been introduced at the undergraduate level at 497 universities in Japan (approximately 67%) by 2012 and at 578 universities (approximately 78%) by 2014 [6,7]. Therefore, in this study, GPA was used as a reflection of learning achievement at the university level and will be compared with other institutions in the future to assess the versatility of the results.

Table 5C: Correlation between four-point scale for learning beliefs/two-point scale for learning strategies and GPA for each academic year in Students enrolled in 2014.

			1st-year GPA	2nd-year GPA	3rd-year GPA
Learning beliefs	Semantic understanding orientation	Correlation coefficient	0.251*	0.317**	0.299**
		Significance probability (two-sided)	0.019	0.003	0.005
	Emphasis on thinking process	Correlation coefficient	0.360**	0.339**	0.309**
		Significance probability (two-sided)	0.001	0.001	0.004
	Flexibility regarding failure	Correlation coefficient	0.156	0.106	0.079
		Significance probability (two-sided)	0.147	0.325	0.470
	Strategy orientation	Correlation coefficient	0.122	0.057	0.017
		Significance probability (two-sided)	0.256	0.598	0.880
Learning strategies	Monitoring strategy	Correlation coefficient	0.372**	0.283**	0.274*
		Significance probability (two-sided)	0.000	0.008	0.011
	Refinement strategy	Correlation coefficient	0.295**	0.264*	0.263*
		Significance probability (two-sided)	0.005	0.013	0.015
**Correlation coefficient is significant at the 1% level (two-sided). *Correlation coefficient is significant at the 5% level (two-sided).					

Table 5D: Correlation between four-point scale for learning beliefs/two-point scale for learning strategies and GPA for each academic year in Students enrolled in 2015

			1st-year GPA	2nd-year GPA
Learning beliefs	Semantic understanding orientation	Correlation coefficient	0.330**	0.294**
		Significance probability (two-sided)	0.001	0.006
	Emphasis on thinking process	Correlation coefficient	0.312**	0.309**
		Significance probability (two-sided)	0.002	0.004
	Flexibility regarding failure	Correlation coefficient	0.133	0.150
		Significance probability (two-sided)	0.196	0.165
	Strategy orientation	Correlation coefficient	0.245*	0.201
		Significance probability (two-sided)	0.016	0.062
Learning strategies	Monitoring strategy	Correlation coefficient	0.419**	0.325**
		Significance probability (two-sided)	0.000	0.002
	Refinement strategy	Correlation coefficient	0.386**	0.296**
		Significance probability (two-sided)	0.000	0.005
**Correlation coefficient is significant at the 1% level (two-sided). *Correlation coefficient is significant at the 5% level (two-sided).				

Table 5E: Correlation between four-point scale for learning beliefs/two-point scale for learning strategies and GPA for each academic year in students enrolled in 2016.

			1st-year GPA
Learning beliefs	Semantic understanding orientation	Correlation coefficient	0.314**
		Significance probability (two-sided)	0.002
	Emphasis on thinking process	Correlation coefficient	0.358**
		Significance probability (two-sided)	0.000
	Flexibility regarding failure	Correlation coefficient	0.244*
		Significance probability (two-sided)	0.020
	Strategy orientation	Correlation coefficient	0.330**
		Significance probability (two-sided)	0.001
Learning strategies	Monitoring strategy	Correlation coefficient	0.503**
		Significance probability (two-sided)	0.000
	Refinement strategy	Correlation coefficient	0.485**
		Significance probability (two-sided)	0.000
**Correlation coefficient is significant at the 1% level (two-sided). *Correlation coefficient is significant at the 5% level (two-sided).			

Correlations were observed between scholastic ability at university entrance and GPA for all evaluated students, but these correlations became less significant with advancement to the next year. "Emphasis on thinking process" and use of the "monitoring strategy" also showed correlations with GPA among all students enrolled between 2012 and 2016. Although "semantic understanding orientation" and "refinement strategy" showed correlations with GPA among students at lower grade

levels, the significance decreased with advancement to the next year.

"Flexibility regarding failure" and "strategy orientation" showed no significant correlation with GPA among the students, with the exception of some lower grade students.

Various factors related to educational psychology involving learning have been examined in previous studies. Ichikawa et al. have described various ways of thinking in elucidating the mechanisms (learning beliefs) and the motivation or purpose (learning motivation) of learning [3]. Ueki has reported that learning beliefs can promote or suppress learning strategies [4], whereas Van Rossum et al. have stated that learning beliefs define the actual course of learning in addition to having an impact on achievement performance [8]. The results of the present survey showed that high aspiration in the four items used to measure learning beliefs and strategies, namely "semantic understanding orientation," "emphasis on thinking process," "monitoring strategy," and "refinement strategy," influence academic performance at the university level. In particular, the influence of high aspiration in "emphasis on thinking process" and "monitoring strategy" appeared to be significant.

Learning beliefs based on "semantic understanding orientation" reflect an attempt to understand the meaning rather than accurately accumulating bits of information through rote memorization. The "refinement strategy" is a learning method that involves accumulating information *via* existing knowledge rather than rote learning [3]. In dental schools, students receive education in the liberal arts to develop basic literacy as well as education on the entire body, including the oral cavity. To comprehend such a wide variety of content from new fields of science, effective learning beliefs and strategies rather than simple memorization are essential.

Learning beliefs based on "emphasis on thinking process" reflect a tendency to value the thinking process rather than the results and to regard the thinking process (processing process) as an interesting and fulfilling activity [3]. The "monitoring strategy" is defined as self-monitoring one's state of understanding from a meta-perspective when solving problems or reading sentences [9]. In dental schools, the ability to interpret, assess, and retain information as well as integrate content learned from individual subjects and clinical reasoning gradually becomes more important from the lower to higher grades levels. An inclination to value the process leading to the correct answer and the learning methods used to confirm one's state are believed to have increased. Hence, to support students, education in accordance with these learning beliefs and strategies will likely be useful.

Shinogaya has stated that the accumulation of learning experiences is necessary to change learning beliefs and that although it is difficult to improve learning achievements by intervention, learning strategies are specific actions that can be easily modified by intervention [10]. However, in the current education system in Japan, students are required to develop learning strategies by trial and error rather than by systematic training, and the process varies among individuals [11]. Although Ueki attempted to teach the "self-monitoring strategy," teaching a strategy for inferring what students cannot understand based on their experiences and knowledge is also required to establish this strategy [12]. Uesaka attempted to teach the "Strategy of Diagram Use" but concluded that the use of diagrams alone is insufficient, as instructions force students to recognize the efficacy of diagrams, making the experience of problem solving using diagrams more effective [13,14]. Hence, the experience and knowledge of students have a greater impact on the establishment of learning strategies than simply teaching the strategies.

Paris et al. have highlighted the importance of conditional knowledge of strategies (knowledge regarding when and why the strategies are useful) [15]. Hadwin et al. have also reported that recognition of the short-term usefulness of strategies for examinations has an impact along with recognition of their future or long-term usefulness [16]. Nevertheless, Murayama has emphasized that the use of a strategy is ineffective unless combined with recognition of the short-term benefits of the strategy, even if the long-term benefits are emphasized during training [17,18]. Hence, to promote the use of learning strategies, increasing the recognition of the short-term benefits of a strategy is believed to be important.

To improve the learning achievements of dental students, increasing student aspiration for "emphasis on thinking process" and "monitoring strategy" is important. In particular, for students with subpar academic performance, direct intervention through education on learning strategies is relatively easy. This approach has the advantages of making the students aware of their own understanding and intellectual state, as well as the characteristics of learning methods, thereby promoting change. Recognition of the short-term benefits of learning strategies can be facilitated by incorporating periodic evaluations of student achievements through the use of short-term strategies. Using this approach, changes in learning strategies over long term can be expected. Moreover, regarding the "emphasis on thinking process" for which it is difficult to promote direct change, the selection of students who take entrance examinations with high aspirations in the interviews for the entrance examination is also necessary. Uesaka encouraged students to be aware of their learning beliefs and has reported that recognition of a connection between learning beliefs and learning achievements leads to observable changes in learning beliefs [19]. During intervention and instructions on learning strategies, changing or establishing learning strategies is anticipated to change learning beliefs as well.

Conclusions

With the ongoing diversification of students and increase in learning demands, in order for higher education to fulfill the expected roles and appropriately respond to social expectations, a system must be established in which subjective willingness to learn depending on the abilities and characteristics of students and their learning achievements can be proactively evaluated [20]. Among the scales of learning beliefs and strategies used in this study, "emphasis on thinking process" and "monitoring strategy"

demonstrated correlations with the learning achievements of dental students and can thus be utilized to classify the abilities and characteristics of dental students.

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Conflicts of Interest

The authors have no conflicts of interest in terms of publication to disclose.

References

1 School basic survey-Overview of (definite data) results in 2015 (2015) Ministry of education, culture, sports, science and technology.

2 Private school management information center, promotion and mutual aid corporation for private schools of Japan, Trend in applicants for admission, private universities/junior colleges in 2012.

3 Shinichi I (1998) In Consultation and instructions for learning methods from the perspective of cognitive counseling. 1st ed, Tokyo: Brain Publication, 186-203.

4 Rie U (2002) Structure of learning view of high school students. Educational Psychology Research 50: 301-310.

5 Towards the development of bachelor's degree education. Central Education Council, Ministry of Education, Culture, Sports, Science and Technology 2008.

6 Office for University Reform, University Promotion Division, Higher Education Bureau, Ministry of Education, Culture, Sports, Science and Technology, Regarding the reform state, etc. of educational contents, etc. at universities, 2013.

7 Office for University Reform, University Promotion Division, Higher Education Bureau, Ministry of Education, Culture, Sports, Science and Technology, Regarding the reform state, etc. of educational contents, etc. at universities, 2014.

8 Rossum EV, Schenk SM (1984) the relationship between learning conception, study strategy and learning outcome. Br J Educ Psychol 54: 73-83.

9 Manaubu I, Kunijiro A (2006) moderator effects of meta-cognition: a test in math of a motivational model. Jpn J Educ Psychol 54: 199-210.

10 Keita S (2012) Learning strategies: A review from the perspective of the relation between learning phases. Jpn J Educ Psychol 60: 92-105.

11 Yusuke H, Keiko N, Masahiro H (2012) Annual report of the Faculty of Education. Faculty of Education, Bunkyo University 46: 45-56.

12 Rie U (2004) Ideal ways to teach students how to utilize self-monitoring strategies: Beliefs about learning and knowledge about strategies. Jpn J Educ Psychol 52: 277-286.

13 Eiji O (2003) Elementary school clinical research 2: 114-119.

14 Yuri U (2009) How learning skills support through cognitive counseling can provide new perspectives in both cognitive research and school curriculum development: focusing on the strategy of diagram use in problem solving. Cognitive Studies 16: 313-332.

15 Paris SG, Lipson MY, Wixson KK (1983) Becoming a strategic reader. Contemp Educ Psychol 8: 293-316.

16 Hadwin AF, Winne PH, Stockley DB, Nesbit JC, Woszczyna C (2001) Context moderates students' self-reports about how they study. J Educ Psychol 93: 477.

17 Kou M (2003) Test format and learning strategy use. Jpn J Educ Psychol 51: 1-12.

18 Kou M (2003) Learning strategy use and short- and long-term perceived utility. Jpn J Educ Psychol 51: 130-140.

19 Yuri U (2010) How learning strategy use transfers across different school subjects: A case study on the promotion of spontaneous use of lesson induction. Jpn J Educ Psychol 58: 80-94.

20 University Council (1998) A Vision of Universities in the first Century and Reform Measures: To be Distinctive Universities in a Competitive Environment (Report) pnb.