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A STUDY ON THE PERCEPTION OF SOUTH KOREAN HIGH SCHOOL STUDENTS ABOUT THE INFLUENCE OF LEARNER AND TEACHER ON SCHOOL SCIENCE LEARNING

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Abstract

This study was conducted on the perception of high school students regarding the influence of learner and teacher on school science learning. The subjects were 867 South Korean high school students at 464 natural science and 404 humanities learning course. The components of the influence of learner and teacher on school science learning consisted of learning motivation, class participation, learning, and achievement. Overall, high school students perceived that learners had a stronger influence than teacher on learning motivation, class participation and achievement except learning. High school students at natural science learning course recognized more than students of humanities learning course that learners had a stronger influence on learning motivation, class participation, and the achievement than teacher. Since high school students at natural science learning course considered their future careers when selecting such learning course, their interests and motivation in science were already higher than students of humanities learning course. Thus, school teachers have to make an effort to develop the professionalism of teaching because the learning effect was not limited to the cognitive skills of science class students, and may vary depending on the explanations of teachers.

Keywords – High school student, Science learning, Influence of learner and teacher, Learning course.

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1. Introduction

Learning is a lasting change in a learner's prior knowledge, motivation, attitude, and behavior (Ambrose, Bridges, DiPietro, Lovett & Norman, 2010; Crow & Crow, 1992). Learning is directly and indirectly influenced by various factors such as teachers, learners, curriculum, and social environment (Choe, Oh & Oh, 2006; Kim et al., 2003; Shin, 2008). Among various intricately intertwined factors, the characteristics of teachers and students have had the greatest influence on successful learning (Kim, Choe, Kang, Kwak, You, Yang et al., 2003; You & Kang, 2012).

Students are able to make effective connections between what they learn during lessons and their previous experiences or knowledge through learning questions and materials fit for their learning levels, and also take part in the interaction process with their teachers and peers (Ha, Shim, Kim & Park, 2008; Mims, 2003; Song & Shim, 2011; Valdez & Bungihan, 2019). Yet when lessons are given in the classroom without consideration of students' levels, such lessons are highly likely to cause students' lethargic reactions or inefficient learning activities (Gardner, 1991; Kim, Song & Shim, 2013; Song & Shim, 2011). Teachers are thus required to promote the active participation of students in lessons through learning questions to stimulate their internal interest, various materials, specific guidance toward learning, introduction of concepts and knowledge with examples and counterexamples, and consideration (Recalde, Palau & Márquez, 2021; Silber, 2007; Shulman, 2005; Tan, Quek & Fulmer, 2019). It is thus evident that both learners and teachers play very important roles during classroom lessons.

In recognition of their important roles, researchers have conducted active research on the learner and teacher factors that influence science learning. They have reported that those factors were closely related to affective characteristics such as learners' motivation and participation in lessons, as well as cognitive characteristics such as scientific thinking skills and academic achievement (Byun & Shim, 2010; Kim, Cho & Chung, 2002; Kim & Chung, 2001; Kim & Han, 2018; Kwon, Hur, Yang & Kim, 2004; Seo, 2007).

Learners' factors include intelligence, cognitive styles, cognitive levels, self-efficacy, attribution tendencies, learning attitude, aptitudes, interest, and learning motivation (Oh & Ku, 1999; Ju, 2005). Of these, motivation is known as the origin of all intentional and goal-oriented human acts (Kim, 1998), and sets goals and directions for human behavior (Deci & Ryan, 2000). Learning motivation is the most critical variable to assess whether the set goals of learning have been achieved (Im, 2011). This is a tendency of recognizing learning activities as meaningful and valuable activities, tries to fulfill the intended learning goals (Brophy, 1988), and gives learners the power to facilitate their learning (Symonds & Chase, 1992). As such, learning motivation is thus considered a core learning factor (Kim & Yu, 2002). In addition, learners' intelligence is also closely connected to their academic achievement (Kim, 2007; Kim & Cho, 2001; Schramm, Jin, Keeling, Johnson & Shin, 2018). The higher students' level of aptitude, interest, and self-efficacy, the more positive their learning attitude and the better their academic achievement (Kim, 2001).

It has been found that teacher factors such as abilities, personality, and behavior have positive effects on learners' learning attitude and academic achievement in science (Kang, Yang & Yeau, 2002; Kim & Yang, 2005). Teachers form very close relations with their students as they interact during lessons (Joo, Lee & Kim, 2012; Lee, 2010). Numerous studies have reported that students' trust in their teachers had positive effects on their learning motivation. A researcher measured teachers' reliability with the Teacher Reliability Scale developed by Lee and Han (2004), and found that all six sub-variables of teacher reliability (ability, openness, trust, intimacy, caring, and sincerity) had positive correlations with students' learning motivation, with "intimacy" most closely correlated with their learning motivation (Lee, 2005; Lim, 2008; Park, 2008). Another study reported that when science teachers provided a positive learning environment, their students' anxiety decreased, they developed a positive attitude toward science, and recorded a high level of science perception and academic achievement (Lee & Kim, 1999).

As the active roles of learners gain more and more importance, they are asked to play a self-directed part in their learning planning and management (Blakey & Spence, 1990). They thus need to develop a sense of responsibility for their learning, which is why active research has been done on various strategies and methods designed to improve such learners' sense of responsibility (Coffman, 2002; Davis & Murrell, 1994; Park, 2003). Some researchers have investigated students' perceptions of factors that affect their success or failure in learning, and found that students attributed their active learning attitude, self-motivation, on-going efforts, and teachers' high explanations to successful learning; while lack of self-motivation and effort, poor time management, and shortage of understanding skills have been attributed to failed learning (Ditcher & Tetley, 1999; Schmelzer, Schmelzer, Figler & Brozo, 1987). This study thus developed a questionnaire on high school students' perceptions about the influence of learner and teacher that affect their learning in science learning; this with the intention to investigate which factors they perceive to have a stronger influence on their science learning, while proposing directions to improve their science learning and providing implications for science education.

2. Methodology

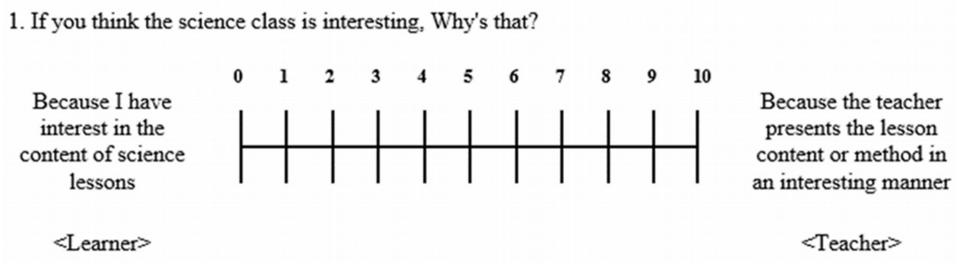
2.1. Instrument

A ten-item questionnaire was developed across the four components of learners' learning motivation, class participation, learning, and the achievement considering the questionnaire developed by Guskey (1981, 1988) to ascertain students' perceptions of factors that influence their science learning. Each item consisted of a student's act and its two causes in science learning. Both learners' and teachers' positions were described at both ends of the response category regarding the causes of students' acts. A bipolar 10-point scale was devised to enable students to select the stronger influence on their acts of science learning. The inventory was tested for content validity by a professor of science education and three experts from related fields, and final items were completed through ongoing revisions (Table 1). The inventory for high school students' recognition of responsibility in science learning recorded a Cronbach α coefficient of 0.82 for reliability level.

Component (No. of questions)	Question item
Learning motivation (3)	If you think school science is interesting, Why's that? If you feel confidence in school science, Why's that? If you feel satisfaction with learning activities in science class, Why's that?
Class participation (3)	If you participate eagerly in science class, Why's that? If you participate eagerly in inquiry activities in science class, Why's that? If you do well in group cooperation activities in science class, Why's that?
Learning (2)	If you understand learning contents well in school science, Why's that? If you remember what you learned well in school science, Why's that?
Achievement (2)	If you get good grades in school science tests, Why's that? If you get grades above your expectations in school science tests, Why's that?

Table 1. Components and items of the instrument for surveying high school students' perception about the influence on school science learning

Below is an example of the questionnaire (No. 1). If responses are less than 5 and closer to 0, it means that they find science lessons interesting because they have interest in the school science lessons, which suggests the great influence of learner factors. Yet responses more than 5 and closer to 10 mean that the teachers apply instructional methods to get students interested in school science lessons, which suggests the great influence of teacher factors.



2.2. Subjects

The subjects were 867 eleventh graders from eight high schools in a metropolitan city and provincial area in South Korea, they comprised 464 subjects from natural science learning course and 403 from humanities learning course (Table 2).

Learning course	Male	Female	Total
Natural science	212	252	446
Humanities	166	237	403
Total	378	489	867

Table 2. Number of research subjects

2.3. Data Analysis

The data collected were analyzed using descriptive statistics and two-way ANOVA with the SPSS PASW Statistics 24.0 program to examine differences in the subjects' responses to questionnaire items according to gender and learning course.

3. Results and Discussion

3.1. Students' Perceptions About the Influence on Their Learning Motivation in School Science

High school students' perceptions about the factors of learner and teacher that influence learning motivation in science lessons are shown in Table 3. The Table 3 shows that the mean score for factors that influence students' interesting in science lessons was 4.65 (SD=2.49), for factors that influence their confidence it was 5.25 (SD=2.25), and for factors that influence their satisfaction it was 4.04 (SD=2.33).

These results indicate that students perceived that learner factors had a stronger influence than teacher factors on their interesting and satisfaction, teacher factors had a stronger influence than learner factors on their confidence. However, overall the students' perceptions were not very biased toward the learner factor and the teacher factor. When students' motivational types are autonomous and self-determination, students can be more immersed in learning situations (Lee, 2001; Lee, 2010; Park, 2005). Those findings raise the need for teachers to make an effort to use various strategies that will motivate students to actively participate in science classes (Wangdl, Chhoden, Chhetri & Tenzin, 2021).

The two-way ANOVA results of high school students' perceptions of factors that influence learning motivation in school science shows that there is no significant interaction between learning course and gender across all questionnaire items ($p>0.05$, Table 4). And, there is no significant difference across all questionnaire items according to gender ($p>0.05$) but significant difference according to learning course ($p<0.05$). These findings indicate that significant differences between the high school students' perceptions were dependent upon which learning course they were in.

Students in the natural science learning course believed that learner factors had a stronger influence on learning motivation than teacher factors compared to those in the humanities learning course. When asked about what made science lessons interesting, students in the natural science learning course said that their learning motivation is affected more by their interest in lesson content than how teachers organized the lesson content or method in an interesting manner. They were more aware of learner factors (M=4.15, SD=2.37) than their counterparts in the humanities learning course (M=5.23, SD=2.30). When asked about their confidence in science lessons, students in the natural science learning course said it was more influenced by how they could exert their abilities than how teachers presented the lesson content according to their level. They were also more aware of learner factors (M=4.90, SD=2.20) than their counterparts in the humanities learning course in terms of confidence (M=5.65, SD=2.23). When asked about their satisfaction with learning activities in science lessons, students in the natural science learning course said that they felt satisfied with learning activities in science lessons because of their sense of achievement rather than teachers' praise, which indicates that they had a higher perception of learner factors' influence on their satisfaction (M=3.76, SD=2.29) than their counterparts in the humanities learning course (M=4.36, SD=2.33).

Students in the natural science learning course exhibited stronger intrinsic motivation, a learner factor, across all items and developed a motivation more voluntarily than their counterparts in the humanities learning course, which is partly because they chose their learning course by taking a career related to science into consideration (Jo, Choi & Cho, 2012; Kim, 2005; Yoon, 2002) and partly because they had greater motivation or interest in science learning and a more positive attitude toward science learning than students in the humanities learning course (Im, 2011, Jung, 2007).

Question		Learning course		Male	Female	Total
If you think school science is interesting, Why's that? 0 1 2 3 4 5 6 7 8 9 10		Natural sci.	M	4.08	4.21	4.15
			SD	2.46	2.30	2.37
		Humanities	M	5.28	5.20	5.23
			SD	2.60	2.07	2.30
Learner factor Because I have interest in the content of science lessons.	***Teacher factor*** Because the teacher presents the lesson content or method in an interesting manner.	Total	M	4.60	4.69	4.65
			SD	2.59	2.25	2.40
If you feel confidence in school science, Why's that? 0 1 2 3 4 5 6 7 8 9 10		Natural sci.	M	4.93	4.87	4.90
			SD	2.43	1.99	2.20
		Humanities	M	5.63	5.65	5.65
			SD	2.42	2.09	2.23
Learner factor Because I can show my ability in science lessons.	***Teacher factor*** Because the teacher presents the lesson content appropriate to me.	Total	M	5.24	5.25	5.25
			SD	2.45	2.08	2.25
If you feel satisfaction with learning activities in science class, Why's that? 0 1 2 3 4 5 6 7 8 9 10		Natural sci.	M	3.84	3.69	3.76
			SD	2.45	2.15	2.29
		Humanities	M	4.30	4.41	4.36
			SD	2.59	2.14	2.33
Learner factor Because I feel the sense of achievement in science lessons.	***Teacher factor*** Because the teacher praises my academic achievement.	Total	M	4.04	4.04	4.04
			SD	2.52	2.17	2.33

Table 3. High school students' perceptions the influence on learning motivation in school science

Question	Source	Sum of squares	Mean squares	F value	P value
If you think school science is interesting, Why's that?	Corrected model	257.211	85.737	15.578	.000
	Learning course	255.189	255.189	46.368	.000
	Gender	.167	.167	.030	.862
	Learning course*gender	2.230	2.230	.405	.525
If you feel confidence in school science, Why's that?	Corrected model	119.954	39.985	8.090	.000
	Learning course	115.649	115.649	23.400	.000
	Gender	.082	.082	.017	.897
	Learning course*gender	.359	.359	.073	.788
If you feel satisfaction in science class learning activities, Why's that?	Corrected model	82.734	27.578	5.138	.002
	Learning course	72.766	72.766	13.557	.000
	Gender	.101	.101	.019	.891
	Learning course*gender	3.907	3.907	.728	.394

Table 4. The two-way ANOVA results of high school students' perception about the influence learning motivation in school science

3.2. Students' Perceptions About the Influence on Their Class Participation in School Science

High school students' perceptions of learner and teacher factors that influence students' participation in science lessons are shown in Table 5. They perceived that learner factors had a stronger influence than teacher factors on their participation in science lessons (M=4.68, SD=2.55), inquiry activities (M=4.52, SD=2.23), and collaborative group activities (M=4.55, SD=2.21).

However, overall the students' perceptions were not very biased toward the learner factor and the teacher factor. Therefore, as the interaction between teachers and students increases, the participation of students in class increases (Skinner, Furrer, Marchand & Kindermann, 2008), teachers should make efforts to provide active support for students to create a comfortable learning atmosphere in which they can actively participate in class.

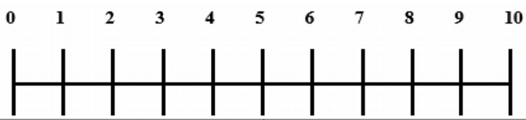
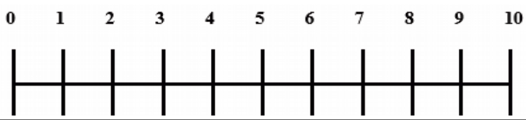
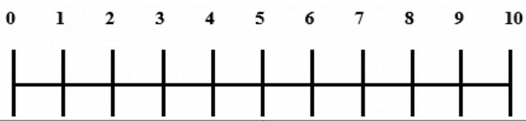
<table>
<tr><th colspan="2">Question</th><th>Learning course</th><th></th><th>Male</th><th>Female</th><th>Total</th></tr>
<tr><td colspan="2" rowspan="4">If you participate eagerly in science class, Why's that?
</td><td rowspan="2">Natural sci.</td><td>M</td><td>3.87</td><td>3.92</td><td>3.90</td></tr>
<tr><td>SD</td><td>2.48</td><td>2.38</td><td>2.42</td></tr>
<tr><td rowspan="2">Humanities</td><td>M</td><td>5.33</td><td>5.75</td><td>5.58</td></tr>
<tr><td>SD</td><td>2.40</td><td>2.39</td><td>2.40</td></tr>
<tr><td rowspan="2">Learner factor
Because I like science lessons.</td><td rowspan="2">Teacher factor
Because the teacher encourages me to participate in science lessons.</td><td rowspan="2">Total</td><td>M</td><td>4.51</td><td>4.81</td><td>4.68</td></tr>
<tr><td>SD</td><td>2.55</td><td>2.55</td><td>2.55</td></tr>
<tr><td colspan="2" rowspan="4">If you participate eagerly in inquiry activities in science class, Why's that?
</td><td rowspan="2">Natural sci.</td><td>M</td><td>3.96</td><td>4.10</td><td>4.03</td></tr>
<tr><td>SD</td><td>2.27</td><td>2.07</td><td>2.16</td></tr>
<tr><td rowspan="2">Humanities</td><td>M</td><td>5.12</td><td>5.05</td><td>5.08</td></tr>
<tr><td>SD</td><td>2.20</td><td>2.18</td><td>2.19</td></tr>
<tr><td rowspan="2">Learner factor
Because I like activities in science lessons.</td><td rowspan="2">Teacher factor
Because the teacher organizes activities in an interesting way.</td><td rowspan="2">Total</td><td>M</td><td>4.47</td><td>4.56</td><td>4.52</td></tr>
<tr><td>SD</td><td>2.31</td><td>2.17</td><td>2.23</td></tr>
<tr><td colspan="2" rowspan="4">If you do well in group cooperation activities in science class, Why's that?
</td><td rowspan="2">Natural sci.</td><td>M</td><td>4.33</td><td>4.40</td><td>4.37</td></tr>
<tr><td>SD</td><td>2.13</td><td>2.29</td><td>2.22</td></tr>
<tr><td rowspan="2">Humanities</td><td>M</td><td>4.85</td><td>4.69</td><td>4.76</td></tr>
<tr><td>SD</td><td>2.34</td><td>2.10</td><td>2.20</td></tr>
<tr><td rowspan="2">Learner factor
Because I am very cooperative.</td><td rowspan="2">Teacher factor
Because the teacher encourages me to cooperate.</td><td rowspan="2">Total</td><td>M</td><td>4.56</td><td>4.54</td><td>4.55</td></tr>
<tr><td>SD</td><td>2.24</td><td>2.20</td><td>2.21</td></tr>
</table>

Table 5. High school students' perceptions about the influence on class participation in school science

The two-way ANOVA results of high school students' perceptions about factors that influence class participation in school science shows that there is no significant interaction between learning course and gender across all questionnaire items($p>0.05$, Table 6). And, there is no significant difference across all questionnaire items according to gender ($p>0.05$) but significant difference according to learning course ($p<0.05$). These findings indicate that significant differences in their perceptions between natural science and humanities learning course.

Question	Source	Sum of squares	Mean squares	F value	P value
If you participate eagerly in science class, Why's that?	Corrected model	627.414	209.138	35.798	.000
	Learning course	573.163	573.163	98.108	.000
	Gender	11.792	11.792	2.018	.156
	Learning course*gender	7.116	7.116	1.218	.270
If you participate eagerly in inquiry activities in science class, Why's that?	Corrected model	238.061	79.354	16.718	.000
	Learning course	236.120	236.120	49.744	.000
	Gender	.214	.214	.045	.832
	Learning course*gender	2.369	2.369	.499	.480
If you do well in group cooperation activities in science class, Why's that?	Corrected model	34.780	11.593	2.367	.070
	Learning course	33.956	33.956	6.931	.009
	Gender	.405	.405	.083	.774
	Learning course*gender	2.729	2.729	.557	.456

Table 6. The two-way ANOVA results of high school students' perception about the influence on class participation in school science

Students in the natural science learning course believed that learner factors had a stronger influence on class participation than teacher factors compared to those in the humanities learning course. When asked about what made them take an active part in science lessons, students in the natural science learning course said that their participation in science lessons was active because they loved science lessons rather than due to the teachers' encouragement. They perceived that learner factors had stronger influences on their participation in science lessons (M=3.90, SD=2.42) than their counterparts in the humanities learning course (M=5.58, SD=2.40). When asked about what made them take an active part in science inquiry activities, students in the natural science learning course said that their participation in science inquiry activities was active because they loved those activities rather than due to the teacher's interesting organization of those activities. They perceived that learner factors had higher influence on their participation in science inquiry activities (M=4.03, SD=2.16) than their counterparts in the humanities learning course (M=5.08, SD=2.19). When asked about what made them good at cooperative learning in groups, students in the natural science learning course said that they were good at cooperative learning in groups because they had a strong teamwork spirit rather than due to the teachers' encouragement. They perceived that learner factors had a greater influence on their cooperative learning in groups (M=4.37, SD=2.22) than their counterparts in the humanities learning course (M=4.76, SD=2.20).

Overall, students in the natural science learning course perceived that learner factors had greater effects on them than students in the humanities learning course, which is partly because they had greater interest or motivation in science than their counterparts in the humanities learning course (Jung, 2007; Seo & Woo, 2009) and partly because they showed greater abilities to make inquiries in science and a bigger preference for inquiry activities than their counterparts in the humanities learning course (Um, 2000). As a result, they took more active participation in science lessons than their counterparts in the humanities learning course.

3.3. Students' Perceptions About the Influence on Learning in School Science

High school students perceived that teacher factors had slightly more influence than learner factors on learning in school science (Table 7). Overall South Korean high school students' perceptions were almost common level toward the learner factor and the teacher factor. The Table 7 shows that the mean score for factors that influence students' understanding learning contents well in science lessons was 5,47 (SD=2.20), for factors that influence their remembrance it was 5.57 (SD=2.42).

Science learning effect was not restricted only to students' cognitive abilities, indeed their understanding level could rise depending on how teachers provide explanations (Suh, Kho & Park, 2009). When students had a positive perception of teachers' support to promote their interest and understanding their meta-cognitive level rose (Kim, Song & Shim, 2013; Song & Shim, 2011), which helped students to easily transfer the learning content to long-term memory and to remember the learning content for a long time (Yeo, 2020). Those findings raise the need for teachers to make an effort to develop their professionalism in lessons.

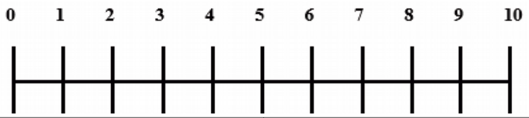
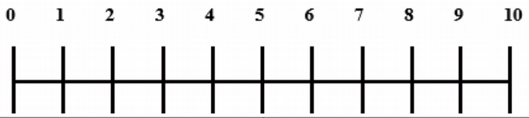
Question		Learning course		Male	Female	Total
If you understand learning contents well in school science, Why's that?		Natural sci.	M	5.24	5.42	5.34
			SD	2.59	2.24	2.40
		Humanities	M	5.54	5.70	5.63
			SD	2.70	2.16	2.39
Learner factor Because I have great understanding.	***Teacher factor*** Because the teacher explains them clearly.	Total	M	5.37	5.55	5.47
			SD	2.64	2.20	2.40
If you remember what you learned well in school science, Why's that?		Natural sci.	M	5.45	5.71	5.59
			SD	2.50	2.31	2.40
		Humanities	M	5.64	5.47	5.54
			SD	2.65	2.28	2.44
Learner factor Because I have great memory.	***Teacher factor*** Because the teacher emphasizes them.	Total	M	5.53	5.59	5.57
			SD	2.57	2.30	2.42

Table 7. High school students' perceptions about the influence on learning in school science

The two-way ANOVA results of high school students' perceptions about factors that influence learning effects in school science shows that there is no significant interaction between learning course and gender across all questionnaire items($p>0.05$, Table 8). In addition, there is no significant difference across all questionnaire items according to learning course and gender ($p>0.05$).

It had been expected that learner factors would have stronger influences on learning effect among students in the natural science learning course than those in the humanities learning course, since the former had greater interest and understanding for science than the latter (Chung & Choi, 2007; Hong & Woo, 2009) and utilized more diverse learning strategies to promote their long-term memory than the latter (Seo & Woo, 2009), and were thus better at understanding or remembering the content of science lessons than the latter. The analysis results, however, indicate that there were no significant differences between the two groups of high school students.

Question	Source	Sum of squares	Mean squares	F value	P value
If you understand learning contents well in school science, Why's that?	Corrected model	24.722	8.241	1.425	.234
	Learning course	17.474	17.474	3.021	.083
	Gender	5.970	5.970	1.032	.310
	Learning course*gender	.014	.014	.002	.961
If you remember what you learned well in school science, Why's that?	Corrected model	11.002	3.667	.624	.599
	Learning course	.074	.074	.013	.911
	Gender	.393	.393	.067	.796
	Learning course*gender	9.779	9.779	1.665	.197

Table 8. The two-way ANOVA results of high school students' perception about the influence on learning in school science

3.4. Students' Perceptions About the Influence on the Achievement in School Science

High school students' perceptions about learner and teacher factors that influence students' academic achievement in science are shown in Table 9. When asked about what contributed to their good grades in science exams, the students said that learner factors had a stronger influence than teacher factors (M=4.91. SD=2.28). When asked about what contributed to their higher than expected scores in science tests, the students said that learner factors had a stronger influence than teacher factors (M=3.99. SD=2.49).

The students perceived that they had prepared well for the exams rather than the teachers taught them well. These results indicate that students perceived that learner factors had slightly more influence than teacher factors on their achievement. This was demonstrated by their answer of good performance in science tests due to own abilities and teachers' excellent instructional methods (Sawyer, 2008; Wangdi et al., 2021). Science teachers' provision of a positive learning environment contributed to their students' higher achievement (Lee & Kim, 1999). This in turn raises the need for teachers to invest a lot of interest and effort in forming relationships with their students, preparing lessons, and giving encouragement.

Question		Learning course		Male	Female	Total
If you get good grades in school science tests, Why's that? 0 1 2 3 4 5 6 7 8 9 10		Natural sci.	M	4.58	4.80	4.70
			SD	2.39	2.03	2.20
		Humanities	M	5.31	5.05	5.16
			SD	2.82	1.95	2.35
Learner factor Because I am good at learning.	***Teacher factor*** Because the teacher is good at teaching.	Total	M	4.90	4.92	4.91
			SD	2.61	1.99	2.28
If you get grades above your expectations in school science tests, Why's that? 0 1 2 3 4 5 6 7 8 9 10		Natural sci.	M	3.60	3.55	3.58
			SD	2.63	2.27	2.44
		Humanities	M	4.80	4.24	4.47
			SD	2.89	2.10	2.47
Learner factor Because I prepare well for the examination.	***Teacher factor*** Because the teacher teaches well.	Total	M	4.13	3.89	3.99
			SD	2.81	2.22	2.49

Table 9. The perception of high school students about the influence on the achievement in school science

The two-way ANOVA results of high school students' perceptions of factors that influence academic achievement in school science shows that there is no significant interaction between learning course and gender across all questionnaire items($p>0.05$, Table 10). And, there is no significant difference across all questionnaire items according to gender ($p>0.05$) but significant difference according to learning course ($p<0.05$). These findings indicate that significant differences between the high school students' perceptions were dependent upon which learning course they were in.

Students in the natural science learning course recognized the influence of learner factors more than their counterparts in the humanities learning course across all items related to academic achievement in science. This is partly because students in the top rank of science grades chose the natural science learning course (Kang, 2013), and partly because students in the natural science learning course had a higher level of academic achievement in science than their counterparts in the humanities learning course. Given the finding that students with higher academic achievement in science tended to have higher self-efficacy and use more diverse and effective learning strategies than those with lower academic achievement in science, and thus record high academic achievement (Jo, 2011; Joo, Chung & Lee, 2011), it is predicted that students in the natural science learning course will have stronger self-efficacy in science than their counterparts in the humanities learning course.

Question	Source	Sum of squares	Mean squares	F value	P value
If you get good grades in school science tests, Why's that?	Corrected model	58.587	19.529	3.771	.010
	Learning course	51.862	51.862	10.014	.002
	Gender	.087	.087	.017	.897
	Learning course*gender	12.415	12.415	2.397	.122
If you get grades above your expectations in school science tests, Why's that?	Corrected model	203.055	67.685	11.238	.000
	Learning course	187.625	187.625	31.151	.000
	Gender	19.187	19.187	3.186	.075
	Learning course*gender	13.116	13.116	2.178	.140

Table 10 The two-way ANOVA results of high school students' perceptions about the influence on the achievement in school science.

4. Conclusion

The present study took an investigation into students' perceptions of learner and teacher factors that influence their learning motivation, class participation, learning effect, and academic achievement in terms of science learning. The findings show that students perceived that learner factors had stronger influences on science learning than teacher factors across all questionnaire items of their class participation and academic achievement. In learning motivation, students perceived that learner factors had a stronger influence than and teacher factors on their interesting and satisfaction except confidence in school science. Also, students perceived that teacher factors had a stronger influence than learner factors across all questionnaire items of learning effect. However, overall the students' perceptions were not very biased toward the learner factor and the teacher factor.

The two-way ANOVA results of high school students' perceptions of factors that influence learning motivation, class participation and academic achievement in school science shows that there is significant difference according to learning course. These findings indicate that significant differences between the high school students' perceptions were dependent upon which learning course they were in. The findings show that students in the natural science learning course said that learner factors had stronger influences on their learning motivation, class participation and academic achievement than teacher factors to a greater degree than their counterparts in the humanities learning course. This is partly because the former had greater interest or motivation for science than the latter, as they chose the natural science learning course when taking their future career into account, and partly because the former had superior science inquiry abilities to the point that they preferred inquiry activities to the latter. And then, students that chose the natural science learning course received higher grades in science than those who chose the humanities learning course or had strong self-efficacy for science, thus highly appreciating the influence of learner factors. However, there were no significant differences in items with regard to learning effect in science between the two learning courses, but the natural science and humanities students generally believed that the teacher factors had a stronger influence than learner factors. Those findings indicate that students in the natural science learning course, despite their high interest in science, are also influenced by how teachers give explanations. This raises the need for teachers to make efforts to increase their teaching professionalism, such as the development of various explanatory approaches to promote easy understanding and good memory of science learning.

In addition, the talents required by the current society are creative convergence talents, and it is the current trend of education to cultivate talents with science and technology abilities and humanities and social sensibilities. Therefore, it is very important for students of humanities to develop basic knowledge about science through science learning. It is necessary to support students with various strategies and methods to help students have a positive attitude toward science so that they can effectively cultivate science and technology abilities.

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