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| Authors      | Wenli Chen, Zhongling Pi, Aileen Chai Siew Cheng, Jesmine S. H. Tan and Xinghua Wang  |
| Source       | <i>Proceedings of the 24th Global Chinese Conference on Computers in Education (GCCCE 2020)</i> (pp. 673-680).                                |
| Organised by | Global Chinese Society for Computers in Education (GCSCE)   |

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# What make students improve argumentation skills in online collaboration?

## The effects of students' motivation and preference for group work

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**Abstract:** *Online collaboration is considered as one of the effective strategies to improve students' argumentation skills. This strategy reduces the effects of production blocking and evaluation apprehension on group performance. There are currently few studies that examine the role of students' characteristics in argumentation skill improvement via online collaboration. During a fifty-minute argumentation lesson conducted by the secondary school English language teacher, students learned to construct argumentation by establishing ideas, claims, and evidence in an attempt to address contemporary issues via an online collaboration system. Prior to the lesson, students completed a motivation scale and preference for group work scale and an argumentation writing task. A similar argumentation writing task was also completed by the students after the lesson. Overall, this study demonstrated that explicit instruction in argumentation skills via online collaboration has positive effects on student' argumentation skills gains, especially on students with a high preference for group work. Results showed that students' extrinsic goal orientation negatively predicted their argumentation skills, whereas students' task value and preference for group work positively predicted their argumentation skills on the posttest. The implications of the findings on the teaching practices of argumentation skills are discussed.*

**Keywords:** argumentation skills, online collaboration, motivation, preference for group work

### 1. Introduction

An educational goal is not only about what students know, but also about how and why they know. When students conduct inquiries, interpret and evaluate evidence and make claims, they construct a deeper understanding of the topic at hand (Simon, Erduran, & Osborne, 2002). Students with good argumentation skill could evaluate the sufficiency or necessity of existing evidence, and judge the validity of claims (Lin & Mintzes, 2010). Argumentation is one of the crucial thinking skills in the toolkit of the 21st century (Trilling & Fadel, 2012).

Online collaboration is considered as one of the potential pedagogical strategies to improve students' argumentation skills (Liu, Liu, & Lin, 2018). There are many benefits of online collaborative argumentation as compared with face-to-face (F2F) collaborative argumentation. One of the benefits with online collaboration is students' ability to share their ideas, claims and evidence simultaneously via an online system without the need to group members would have to take turns to express their ideas. Specifically, online collaborative argumentation settings reduce production blocking and students could share their ideas, claims and evidence without the limitation of turn-taking and shame avoidance (Paulus & Nijstad, 2003). This would expose them to multiple perspectives and thus stimulate their improvement in argumentation (Noroozi, Hatami, Bayat, van Ginkel, Biemans, & Mulder, 2018). It should be noted that not every student can be equally stimulated for argumentation to take place. Previous studies on collaborative argumentation have shown that most students are inadequately prepared to analyze the claims and evidence shared by others and to construct their own arguments (Naylor, Keogh & Downing, 2007). Therefore, it is reasonable to assume that students' characteristics could affect their achievement in online collaborative argumentation.

Motivation is a crucial factor that affects students' academic achievement (Mega, Ronconi, & De Beni, 2014). It is dynamic and contextually bound, that is, students' motivation varies in different lessons (Duncan & McKeachie, 2005).

According to Duncan and McKeachie (2005), motivation includes six dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. Intrinsic goal orientation means that students focus on learning and mastery; whereas extrinsic goal orientation means that students focus on grades and approval from others when they are learning. Task value refers to students' judgements of how interesting, useful, and important is the course content. Control of learning beliefs refers to students' beliefs that outcomes are contingent on one's own effort, rather than external factors such as the teacher or luck. Self-efficacy for learning and performance refers to students' judgments of their ability to accomplish a task and confidence in one's skills to perform a task are collapsed within the general term self-efficacy. Finally, test anxiety refers to students' worry and concern over taking examinations.

Accumulative studies have shown that students with different academic achievements (e.g., high, average, and low) show differences in their motivation (Turner, Chandler, & Heffer, 2009). For example, students' intrinsic motivation, task value, control of learning beliefs, and self-efficacy for learning and performance positively predict their academic achievement. This is because students with high characteristics in these dimensions tend to engage in deep-processing strategies and metacognitive regulation whereas students' extrinsic goal orientation and test anxiety negatively predict their deep-processing strategies and achievement (Høigaard, Kovac, Øverby, & Haugen, 2015; Turner et al., 2009). Therefore, it is reasonable to assume that students' motivation may be related to their argumentation skills improvement via online collaboration.

Furthermore, the improvement of students' argumentation skills might be influenced by their preference for group work via online collaboration. Students' preference for group work refers to the degree to which students have strong preferences for group work rather than individual work (Shaw, Duffy, & Stark, 2000). Previous studies have shown that the students who have a strong preference for group work display better individual performance of various tasks in groups (Shaw et al., 2000). For example, students with a strong preference for group work perform better with decision-making and creative tasks in a group context (Larey & Paulus, 1999; Tekleab & Quigley, 2014). Thus, it logically follows that the students who prefer group work would be more satisfied and perform more effectively in group settings, while those with a preference for individual work would be more satisfied and perform more effectively when tasks are more individualized. Taken together, these studies support the view that students' preference for group work is strongly related to their performance in the group context.

Currently, there are few studies that test the role of students' characteristics in argumentation skills improvement via online collaboration. Hence, this study will focus mainly on the relationship between students' characteristics of motivation and preference for group work and their acquisition of argumentation skills through online collaboration by comparing their argumentation skills from the pretest and the posttest.

On the basis of previous studies, we hypothesized that: (1) Students' argumentation skills would be improved after the online collaborative argumentation intervention. (2) Students' intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance would positively predict their argumentation skills on the posttest, while students' extrinsic goal orientation and test anxiety would negatively predict their argumentation skills on the posttest. (3) Students' preference for group work would positively predict their argumentation skills after online collaborative argumentation intervention. (4) Students with a high level of intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance would show better argumentation skills on the posttest than on the pretest, while students with a low level of these characteristics would gain similar scores on the pretest and posttest of argumentation. (5) Students with a low level of extrinsic goal orientation and test anxiety would show better argumentation skills on the posttest than the pretest, while students with a high level of these characteristics would gain similar scores on the pretest and posttest of argumentation. (6) Students with a strong preference for group work would show better argumentation skills on the posttest than on the pretest.

## 2. Methods

### 2.1. Participants, Context and intervention

A class of 37 secondary one students (13 years old on average) in Singapore participated in the study. All students were proficient in using the computer as a learning tool. All the students were heterogeneously grouped by the teacher. There were ten groups, with three to four students in each group. Each group comprises students of varying academic abilities. The teacher had two years of experience in English language teaching and she is tech-savvy. The teacher and students had given written informed consent for this study.

Prior to the study, researchers provided professional development sessions on how to design and deliver collaborative argumentation lessons via an online collaborative system developed by our research team. The collaborative argumentation activities were co-designed by the teacher and the researchers. Students were tasked to answer the argumentation question “Do you agree that social media negatively influences youth’s ideas of harmony in Singapore?” during the fifty-minute English language lesson that took place in the computer laboratory. Before the intervention, all students completed a survey on motivation and preference for group work. Students addressed the argumentative question by constructing and refining their explanations via the online collaborative system. All students were also tasked to write argumentative essays to the same question before and after the lesson as pretest and posttest.

### 2.2. Online collaboration system

The AppleTree system developed by the authors (Figure 1) was employed for the online argumentation task. This system was designed for supporting generalized coordination of collaborative argumentation among students. The system possesses a graph-based argumentation workspace to represent argument elements, where a cloud represents an idea, an ellipse represents a claim, and a rectangle represents an evidence.

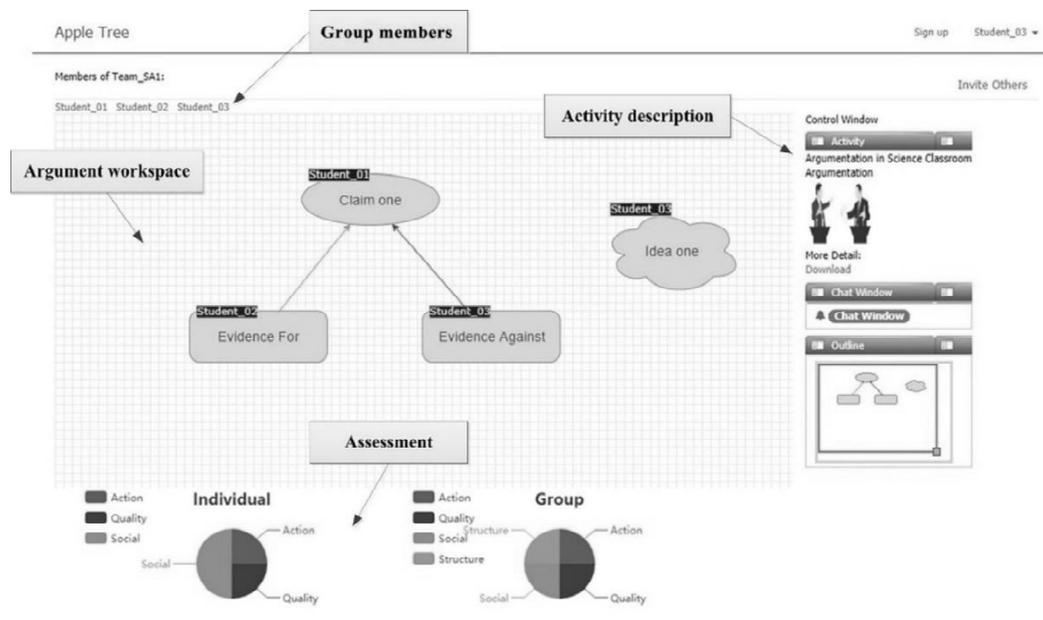


Figure 1. Screenshot and explanation of AppleTree system.

### 2.3. Measures

#### 2.3.1. Motivation scale

Motivated Strategies for Learning Questionnaire (MSLQ) motivation scale was used to measure students’ motivation (Duncan & McKeachie, 2005). The scale included 31 items and the items were divided into six dimensions: intrinsic goal

orientation (four items), extrinsic goal orientation (four items), task value (six items), control of learning beliefs (four items), self-efficacy for learning and performance (eight items), and test anxiety (five items). Students answered the items on a 5-point Likert-type scale, from 1 (not at all true of me) to 5 (very true of me). Each dimension had satisfactory reliability in the study (Respectively, Cronbach's  $\alpha = 0.82, 0.79, 0.88, 0.76, 0.91, 0.74$ ).

### 2.3.2. Preference for group work scale

Eight items were used to measure students' preference for group work from the preference for group work scale (Shaw et al., 2000) and group preference scale (Larey & Paulus, 1999). Students responded to the items on a 5-point Likert-type scale, from 1 (not at all true of me) to 5 (very true of me). The scale had satisfactory reliability in the study (Cronbach's  $\alpha = 0.91$ ).

### 2.4. Rubrics for students' argumentation essays

Students' argumentative essays were assessed by their performance in the argumentation question: Do you agree that social media negatively influences youth's ideas of harmony in Singapore? Each student's answer was rated on a 4-point scale by the teacher. The rubrics are shown in Table 1.

Table 1. The rubrics of argumentation.

|                | Level 1:  | Level 2:   | Level 3:   | Level 4:  |
|----------------|---|--|--|---|
| Criteria       | Below Expectations  | Approaching Expectations   | Meeting Expectations   | Exceeding Expectations                                  |
| Explanation    | No evidence.  | Attempt that providing evidence.   | Provides adequate evidence.                                      | Provides substantial evidence.                          |
| Rating details | Uses details and pieces of evidence that are inadequate and irrelevant. | Uses details that attempt to develop the argument but there may be contradictions and omissions. | Uses details and evidence that develop and support the argument. | Use details and evidence that strengthens the argument. |

## 3. Results

### 3.1. Effects of intervention

The descriptive statistics of students' argumentation indicate that their performance on the pretest was generally not good before the instruction (mean ( $M$ ) = 1.86, standard deviation ( $SD$ ) = 0.67). After the instructional intervention, the students demonstrated improved skills in making claims, evidence, and ideas on the posttest ( $M = 2.30, SD = 0.91$ ). The simple univariate effect of the instructional treatment was explored by comparing total pretest and posttest argumentation scores for all students, using a paired t-test. As our hypothesis predicted, students' scores on posttest were higher than scores on pretest ( $t(36) = 2.74, p = .009$ ). Initially, it seemed that the students' argumentation skills were significantly enhanced by the treatment.

### 3.2. Motivation and preference for group work as predictors of argumentation skills

In order to explore the combined and relative effects of intrinsic goal orientation ( $X_{11}$ ), extrinsic goal orientation ( $X_{12}$ ), task value ( $X_{13}$ ), control of learning beliefs ( $X_{14}$ ), self-efficacy for learning and performance ( $X_{15}$ ), test anxiety ( $X_{16}$ ), and preference for group work ( $X_2$ ) on argumentation skills ( $Y$ ), six dimensions on motivation and preference for group work were entered into a multiple linear regression analysis to predict posttest scores:  $Y = \text{Constant} + \alpha X_{11} + \beta X_{12} + \gamma X_{13} + \delta X_{14} + \varepsilon X_{15} + \zeta X_{16} + \eta X_2$  ( $\alpha, \beta, \gamma, \delta, \varepsilon, \zeta,$  and  $\eta$  in the equation are regression coefficients of different dependents).

As partially hypothesized, students' extrinsic goal orientation negatively predicted their argumentation skills on posttest, but students' task value and preference for group work positively predicted their argumentation skills (Table 2). The results suggested that students with a high level of extrinsic goal orientation showed lower argumentation skills, but students with a high level of task value and preference for group work showed high argumentation skills.

Table 2. Results of multiple linear regression analysis.

| Model                                      | Unstandardized B | Coefficients SE | Standardized Coefficients Beta | <i>t</i> | <i>p</i> |
|--|------------------|-----------------|--------------------------------|----------|----------|
| Constant                                   | 2.97             | 1.18            |                                | 2.51     | .018     |
| Intrinsic goal orientation                 | -0.03            | 0.61            | -0.02                          | -0.05    | .957     |
| Extrinsic goal orientation                 | -0.57            | 0.29            | -0.38                          | -1.98    | .058     |
| Task value                                 | 1.14             | 0.57            | 0.61                           | 1.99     | .056     |
| Control of learning beliefs                | -0.29            | 0.55            | -0.16                          | -0.53    | .602     |
| Self-efficacy for learning and performance | -0.82            | 0.47            | -0.45                          | -1.74    | .093     |
| Test anxiety                               | -0.26            | 0.28            | -0.17                          | -0.92    | .365     |
| Preference for group work                  | 0.63             | 0.30            | 0.38                           | 2.07     | .047     |

### 3.3. Effect of extrinsic goal orientation on argumentation skills

To test the effect of students' extrinsic goal orientation on argumentation skills, students were classified as low extrinsic goal orientation and high extrinsic goal orientation. The descriptive statistics are shown in Table 3.

Table 3. Descriptive statistics of argumentation skills among students with low and high extrinsic goal orientation.

| Argumentation | Extrinsic goal orientation | <i>n</i> | <i>M</i> | <i>SD</i> |
|---------------|----------------------------|----------|----------|-----------|
| Pretest       | Low                        | 19       | 2.05     | 0.71      |
|               | High                       | 18       | 1.67     | 0.59      |
| Posttest      | Low                        | 19       | 2.58     | 0.77      |
|               | High                       | 18       | 2.00     | 0.97      |

A Repeated Measurement Analysis of Variance (ANOVA) was conducted, with argumentation test as within-subjects factor and students' classification as between-subjects factor. The main effects of argumentation test and students' classification were observed, but the predicted interaction was not found (Table 4). The main effect of argumentation test showed that students gained higher scores on the posttest than on the pretest; and the effect of students' classification showed that students with low extrinsic goal orientation gained higher argumentation skills than those with high extrinsic goal orientation (Figure 2a).

Table 4. The results of ANOVA.

| Classification criterion   | Source of variation          | Type III sum of squares | <i>df</i> | <i>F</i> | <i>p</i> | $\eta_p^2$ |
|----------------------------|------------------------------|-------------------------|-----------|----------|----------|------------|
| Extrinsic goal orientation | Test                         | 3.42                    | 1         | 7.30     | .011     | 0.17       |
|                            | Classification               | 4.30                    | 1         | 5.97     | .020     | 0.15       |
|                            | Test $\times$ classification | 0.17                    | 1         | 0.37     | .548     | 0.01       |
| Task value                 | Test                         | 3.39                    | 1         | 7.37     | .010     | 0.17       |
|                            | Classification               | 0.20                    | 1         | 0.24     | .629     | 0.01       |
|                            | Test $\times$ classification | 0.42                    | 1         | 0.91     | .347     | 0.03       |
|                            | Test                         | 3.64                    | 1         | 8.73     | .006     | 0.20       |

|                           |                       |      |   |      |      |      |
|---------------------------|-----------------------|------|---|------|------|------|
| Preference for group work | Classification        | 2.71 | 1 | 3.54 | .068 | 0.09 |
|                           | Test × classification | 2.09 | 1 | 5.06 | .031 | 0.13 |

Note: We used a significance level of .05 for all analyses. Partial eta square ( $\eta_p^2$ ) was reported as a measure of effect size for the ANOVAs, with  $\eta_p^2 = 0.01$ ,  $\eta_p^2 = 0.06$ , and  $\eta_p^2 = 0.14$  corresponding to small, medium, and large effects, respectively (Cohen, 1988).

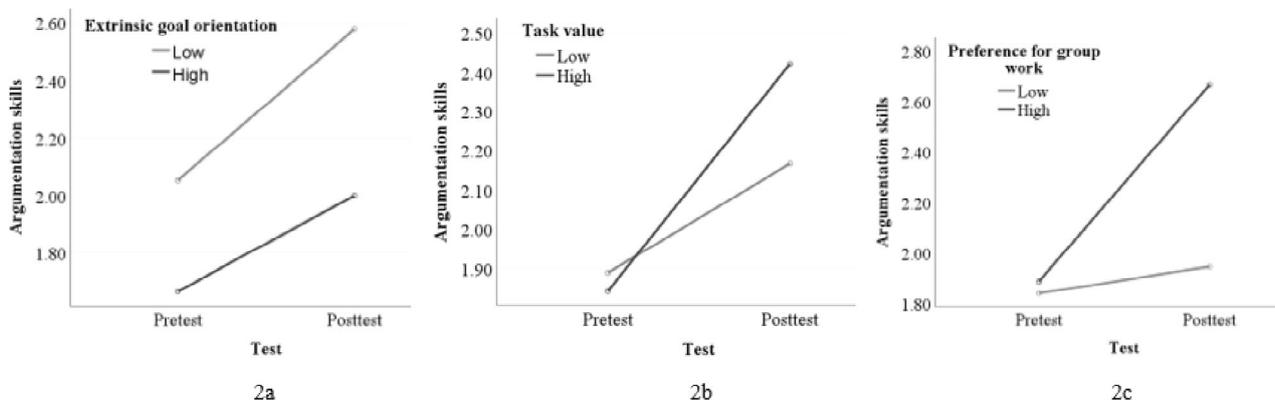


Figure 2. The differences on pretest and posttest between the students with low and high extrinsic goal orientation.

### 3.4. Effect of task value on argumentation skills

To test the effect of students' task value on argumentation skills, students were classified as low task value and high task value. The descriptive statistics were shown in Table 5.

Table 5. Descriptive statistics of argumentation skills among students with low and high task value.

| Argumentation | Task value | <i>n</i> | <i>M</i> | <i>SD</i> |
|---------------|------------|----------|----------|-----------|
| Pretest       | Low        | 18       | 1.89     | 0.83      |
|               | High       | 19       | 1.84     | 0.50      |
| Posttest      | Low        | 18       | 2.17     | 0.86      |
|               | High       | 19       | 2.42     | 0.96      |

The ANOVA results only found the main effect of argumentation test, not the main effect of students' classification and the predicted interaction (Table 4). The main effect of argumentation test showed that students gained higher scores on the posttest than on the pretest (Figure 2b).

### 3.5. Effect of preference for group work on argumentation skills

To test the effect of students' preference for group work on argumentation skills, students were classified as having a low preference for group work and high preference for group work. The descriptive statistics is shown in Table 6.

Table 6. Descriptive statistics of argumentation skills among students with low and high preference for group work.

| Argumentation | Preference for group work | <i>n</i> | <i>M</i> | <i>SD</i> |
|---------------|---------------------------|----------|----------|-----------|
| Pretest       | Low                       | 19       | 1.84     | 0.83      |
|               | High                      | 18       | 1.89     | 0.47      |
| Posttest      | Low                       | 19       | 1.95     | 0.71      |
|               | High                      | 18       | 2.67     | 0.97      |

The ANOVA results showed the main effect of argumentation test, the interaction, and the main effect of students' classification reached marginally significance (Table 4). As expected, students with high preference for group work gained higher scores on the posttest than on the pretest ( $t(17) = 3.76, p = .002$ ), while those with low preference for group work gained similar scores on the posttest with the pretest ( $t(18) = 0.49, p = .630$ ) (Figure 2c).

#### 4. Discussion

This study examined the effects of students' motivation and preference for group work on their argumentation skills improvement after an online collaborative argumentation intervention. The results confirmed the beneficial effects of the online collaborative argumentation intervention on improving students' argumentation skills. More importantly, students' extrinsic goal orientation negatively predicted their argumentation skills, but students' task value and preference for group work positively predicted their argumentation skills on the posttest. Interestingly, students having a strong preference for group work showed more argumentation skills gains than those having a weak preference for group work. This study represents unique contributions to the argumentation literature in that the findings highlight the interaction role of students' characteristics and the online collaboration instruction for students' argumentation skills.

Previous research has shown that middle school, high school, and undergraduate students can be taught to construct better arguments when the teacher explicitly focuses on argumentation skills and provides opportunities for practising these skills (Osborne et al., 2004). Results from this study are consistent with past studies as they had demonstrated that the online collaborative argumentation intervention was able to help students improve their argumentation skills (Osborne, Erduran, & Simon, 2004). However, this simple picture became substantially more complex after further consideration of the effects of students' characteristics on their argumentation skills.

Considering students' motivation, we found that students having a low level of extrinsic goal orientation, but having a high level of task value tended to gain more argumentation skills after the collaborative intervention. As mentioned earlier, introducing incentives, such as food and water, disrupted rather than facilitated puzzle-solving among their subjects, rhesus monkeys, extrinsic motivation can have a negative connotation (Lin, McKeachie, & Kim, 2003). Furthermore, extrinsic rewards undermined the students' feeling of self-determination and freedom of choice (Deci & Ryan, 1991). Therefore, the students having higher extrinsic goal orientation gained fewer argumentation skills after the intervention. In addition, students with high task value were more likely to use deep-processing strategies and metacognitive regulation (Høigaard et al., 2015; Turner et al., 2009). Therefore, those students used their cognitive sources to master argumentation skills.

Moreover, the results of the study further suggest that explicit instruction in argumentation skills could have more positive effects on students with a high preference for group work, which is also consistent with previous studies (Lin & Mintzes, 2010; Tekleab & Quigley, 2014). For example, Lin and Mintzes (2010) found that nearly half of the students, including some high achievers, did not demonstrate well-developed skills in making arguments. Argumentation is one of the high order thinking skills, and it is a more difficult cognitive task for most students (Garcia-Mila & Andersen, 2007). During the collaboration, the students with a strong preference for group work tended to interact more with their peers, and consequently, they were more likely to share their ideas, claims, and evidence with peers; whereas, the students with a low preference for group work preferred to solve problems by themselves. Therefore, they were more prone to answering argumentation questions on their own (Larey & Paulus, 1999; Tekleab & Quigley, 2014). Therefore, the students with a strong preference for group work mastered more argumentation skills after online collaboration intervention. This illustrates that individual differences in learning argumentation skills and knowledge about the issue cannot be ignored.

To conclude, what stands out in the present study is that explicit instruction in argumentation skills via online collaboration has positive effects on student' argumentation skills gains, especially on students with high preference for group work; students' extrinsic goal orientation negatively predicted, but students' task value and preference for group work positively predicted their argumentation skills on the posttest. The findings lead to a strong recommendation for

explicit argumentation teaching: Teachers should reduce students' extrinsic goal orientation, but increase the task value and students' preference for group work.

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