# Students' Perceived Autonomy Support as a Possible Source of Mathematics Self-Efficacy

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## Theoretical Framework

- In the academic domain, **self-efficacy** is defined as the beliefs students hold about their capability to successfully perform and complete academic tasks (Bandura, 1997; Pajares, 2006).

- According to Bandura (1997), self-efficacy beliefs that students form and develop are influenced primarily by four sources:

  - **Mastery Experiences:** Interpretation of students' own performance
  - **Vicarious Experiences:** Observing others performs tasks-models and social comparisons
  - **Social Persuasions:** Verbal messages students' receive from teachers and parents
  - **Physiological States:** Emotional states such as anxiety and stress

- Although **Bandura's model** contains important information about one's capabilities such as previous attainments, influences of teachers, parents, and friends, social models, and stress, it does not appear to take into consideration an individual's **sense of autonomy support** and the role it might play in the construction of self-efficacy beliefs.

- Ryan and Deci's (2000) **self-determination theory** states that autonomy is one of the basic human psychological needs that when fostered in social contexts, promotes positive learning experiences.

  - When students' feel autonomous, they are intrinsically motivated to perform tasks with a higher degree of aspiration and a sense of choice, without being persuaded by external factors (Jang, Reece, Ryan, & Kim, 2009; Ryan & Deci, 2000).
  - **When they feel autonomous, students likely also experience a stronger belief in their own competence.**

## Purpose of the Study

This study addresses the following research questions:

- What is the relationship between perceived autonomy support and Bandura's theorized sources of self-efficacy beliefs among middle school mathematics students?
- How do Bandura's theorized sources of self-efficacy influence students' self-efficacy?
- Does the inclusion of perceived autonomy support add to the prediction of self-efficacy?

## Method

### Participants and Data Sources

Participants were 1,820 students enrolled in Grades 6 to 8 to from four middle schools in the southeastern region of the Unites States. Students completed an online survey developed in Qualtrics. The survey was designed to assess students' beliefs about learning and doing mathematics, and asked students to provide judgments about how true or false they found a particular statement along a 6-point Likert-type scale. The survey included the following measures (see Table 1):

- The four hypothesized *sources of self-efficacy* were assessed with a 24-item scale developed by Usher and Pajares (2009) for use with middle school mathematics students.

- Six items from the Learning Climate Questionnaire (Black & Deci, 2000) were used to assess students' *perceived autonomy support*.

- Three self-efficacy measures were used targeting *General Mathematics Self-Efficacy, Math Test-Taking Self-Efficacy,* and *Math Skills Self-Efficacy* (XX items). All measures adhered to Bandura's (2006) guidelines for constructing self-efficacy scales.

### Analyses

Means, standard deviations, and zero-order correlations were calculated for all variables of interest. We then ran three multiple hierarchical linear regression models in which, at Step 1, each self-efficacy measure was regressed on the four hypothesized sources. In Step 2, perceived autonomy support was entered. $R^2$ values of the two models were then compared.

Table 1
*Sample Items Used in the Study*

| Variable | Sample Item | Cronbach's alpha (a) |
|---|---|---|
| General Mathematics Self-Efficacy | In general, how confident are you in your abilities in math? | .881 |
| Mathematics Test Taking Self-Efficacy | How confident are you that you can do well on standardized tests in math? | .894 |
| Mathematics Skills Self Efficacy | Multiplication with two digit numbers | .962 |
| Mastery Experience | I have always been successful with math. | .861 |
| Vicarious Experience | Seeing adults do well in math pushes me to do better. | .747 |
| Social Persuasions | My math teachers have told me that I am good at learning math. | .871 |
| Physiological State | Just being in math class makes me feel stressed and nervous. | .862 |
| Perceived Autonomy Support | My math teacher lets me choose what I learn about in math. | .864 |

## Results

Table 2
*Means, Standard Deviations, and Zero-Order Correlations for Variables in the Study*

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. General Math Self-Efficacy | 4.77 | 1.08 | | | | | | | |
| 2. Math Test Taking Self-Efficacy | 4.71 | 1.11 | .84 | | | | | | |
| 3. Math Skills Self Efficacy | 5.11 | 0.82 | .67 | .67 | | | | | |
| 4. Mastery Experience | 4.34 | 1.14 | .61 | .58 | .48 | | | | |
| 5. Vicarious Experience | 3.95 | 0.96 | .42 | .41 | .36 | .54 | | | |
| 6. Social Persuasions | 3.93 | 1.27 | .54 | .52 | .44 | .74 | .61 | | |
| 7. Physiological State | 2.56 | 1.23 | -.48 | .44 | -.38 | -.65 | -.38 | -.51 | |
| 8. Teacher Autonomy Support | 4.17 | 1.21 | .40 | .33 | .32 | .26 | .32 | .29 | -.26 |

*Note.* All correlations are significant at *p* < .01 level

Table 3
*Hierarchical Linear Regression Results for the Prediction of Mathematics Self-Efficacy*

| Variables | General Math Self-Efficacy | | Math Test Taking Self-Efficacy | | Math Skills Self-Efficacy | |
|---|---|---|---|---|---|---|
| | Step 1 | Step 2 | Step 1 | Step 2 | Step 1 | Step 2 |
| Mastery Experience (β) | .355* | .365* | .341* | .348* | .187* | .192* |
| Vicarious Experience (β) | .086* | .030 | .099* | .060 | .093* | .061* |
| Social Persuasions (β) | .127* | .103* | .140* | .124* | .084* | .071* |
| Physiological State (β) | -.114* | -.084* | -.089* | -.068* | -.066* | -.049* |
| Teacher Autonomy Support (β) | | .209* | | .145* | | .118* |
| F | 307.724 | 299.294 | 256.138 | 224.688 | 157.042 | 143.385 |
| Model $R^2$ | .404* | **.452*** | .361* | **.382*** | .256* | **.282*** |
| $R^2$ change | .048* | | .021* | | .026* | |

*Note.* **p* < .001 level

## Key Findings

- The four sources of self-efficacy and perceived autonomy support were significantly interrelated.

- All four hypothesized sources predicted math self-efficacy, but mastery experience was the strongest predictor.

- When perceived teacher autonomy support was considered as an additional source, the regression model (Step 2) revealed it to be a significant source of mathematics self-efficacy. The change in $R^2$ between all three models was significant, indicating that autonomy support explains a significantly proportion of the variance in self-efficacy over and above that explained by the four Bandura's hypothesized sources.

## Discussion and Implications

- Our findings suggest that autonomy support is a significant predictor of self-efficacy and should be considered by education researchers who are interested in determining various classroom practices that foster and nurture middle school students' confidence in mathematics.

- Results also suggests that autonomy support is significantly interrelated with students' reported mastery experiences, social persuasions, vicarious experiences, and physiological states.

- This study could provide the following implications for teachers:

  - Teachers should create an environment that fosters the development of students' self-efficacy beliefs in the domain of mathematics and related disciplines.
  - **Teachers should consider shifting from using traditional methods to more learner-centered methods that support students' autonomy and promote individuality.**
  - Teachers might benefit from help designing strategies that encourage students' autonomy when learning and doing mathematics.

- Researchers who investigate self-efficacy might benefit from insights from other motivation theories to better understand and explain students' competence and confidence in academics. In particular, they might include measures of perceived autonomy support.

- Next steps: Investigating how our findings might vary as a function of students' gender, grade, and school-level. Do the sources of self-efficacy operate similarly for students in all groups?

- Future studies could include a replication of this study in other academic domains such as reading and language arts.

## References

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology, 52,*1-26.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. Urdan (Eds.). *Self-efficacy beliefs of adolescents,* (Vol. 5., pp. 307-337). Greenwich, CT: Information Age Publishing.

Jang, H., Reeve, J., Ryan, R. M., Kim, A. (2009). Can self-determination theory explain what underlies the productive, satisfying learning experiences of collectivistically oriented korean students?. *Journal of Educational Psychology, 101,* 644-661.

Pajares, F. (2006). Self-efficacy beliefs during adolescence: Implications for teachers and parents. In F. Pajares & T. Urdan (Eds.), *Adolescence and education, Vol. 5: Self-efficacy beliefs of adolescents* (pp. 339-367). Greenwich, CT: Information Age Publishing

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25,* 54-67.