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RESEARCH BULLETIN

TEAM-BASED FLIPPED CLASSROOM: EFFECTS ON STUDENT ATTITUDE, MOTIVATION, ENGAGEMENT, AND ACHIEVEMENT IN MATHEMATICS

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INTRODUCTION

The cycle of Mathematics learning showed that a positive attitude towards Mathematics increases motivation, leading to active engagement in learning and higher achievement (Kennedy, 2019). Among Filipinos, attitude towards mathematics is moderately positive or fair (Silao, 2018). Furthermore, Filipino students lack motivation in mathematics. High levels of extrinsic motivation with high test anxiety levels are also observed (Adao et al., 2015). Given these problems with attitude and motivation in a mathematics class, poor student engagement follows. Improving attitude, motivation, engagement, and achievement in Mathematics can be done through appropriate teaching-learning pedagogies. Siegle (2013) stated that changing the way classroom instruction is delivered, not solely with new technology, can improve student's mathematics achievement and other factors affecting it.

The team-based flipped classroom (TBFC) is a student-centered flipped classroom strategy and a highly structured type of cooperative learning (River et al., 2016). Instructions are delivered in a flipped model, while class sessions are done through the phases of team-based learning. TBL has three phrases: Phase 1, advanced assignment through a flipped classroom model; Phase 2, readiness assurance tests for both individual and team; and Phase 3, application of course concepts (Kim et al., 2016).

This study investigated the effects of TBFC on students' attitude (i.e., self-confidence, value, and enjoyment), motivation (i.e., intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs for learning, self-efficacy, and test anxiety), engagement (i.e., behavioral, emotional, cognitive, and social), and achievement compared to the conventional classroom (CC). It also analyzed its effects on students with different achievement levels and determined which among the aforementioned student variables predict achievement. The study used a combination of quantitative, Matching-Only Pretest-Posttest Control Group Design, and qualitative approaches.

DISCUSSION OF RESULTS

Table 1 shows that students exposed to the TBFC had significantly higher positive attitudes towards mathematics than those exposed to the conventional classroom, $t(51) = -2.53$, $p = .015$. They also had higher levels of self-confidence and value.

Table 1

Comparison of students' attitude as exposed to a team-based flipped classroom and as exposed to conventional classroom

Variables	Conventional Classroom		Team-based Flipped Classroom		*t*(51)	*p*
	M	*SD*	*M*	*SD*		
Attitude towards Mathematics	3.0	0.6	3.3	0.5	-2.55	.014*
Self-confidence	2.6	0.7	3.0	0.7	-2.53	.015*
Value	3.6	0.6	3.9	0.5	-2.18	.034*
Enjoyment	3.0	0.7	3.2	0.6	-1.34	.187

Note. Attitude mean scores can be interpreted as *highly positive* (4.6 – 5.0), *positive* (3.6 – 4.5), *moderately positive* (2.6 – 3.5), *negative* (1.6 – 2.5), and *highly negative* (1.0 – 1.5).
*$p < .05$

Table 2 reveals that TBFC students had higher levels of engagement compared to CC students, $t(51) = -2.15$, $p = .036$. Analyzing the four domains of engagement, TBFC students only showed higher levels of emotional engagement.

Table 2

Comparison of student engagement as exposed to a team-based flipped classroom and as exposed to conventional classroom

Variables	Conventional Classroom		Team-based Flipped Classroom		*t*(51)	*p*
	M	*SD*	*M*	*SD*		
Engagement	41.0	29.6	57.8	27.0	-2.15	.036*
Behavioral Engagement	42.3	29.3	53.0	29.1	-1.32	.193
Emotional Engagement	37.1	28.6	58.0	26.6	-2.71	.009**
Cognitive Engagement	38.6	29.5	54.2	29.9	-1.90	.063
Social Engagement	39.9	28.0	49.6	30.1	-1.20	.236

Note. For engagement, mean percentile ranks can be interpreted as *high engagement* (76th to 99th), *average engagement* (26th to 75th), and *low engagement* (1st to 25th).

*p < .05. **p < .01.

Furthermore, students exposed to the TBFC had higher achievement test scores than students exposed to the conventional classroom, $t(51) = -2.03$, $p = .048$. In comparing the effect of the team-based flipped classroom on learners with different levels, outstanding learners showed higher cognitive engagement levels.

Table 3

Difference in achievement between students exposed to team-based flipped classroom and students exposed to conventional classroom

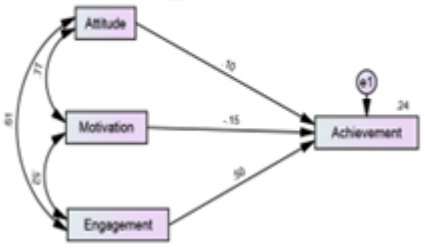
Group	*M*	*SD*	*t*(51)	*p*
Conventional Classroom	49.75	17.99	-2.03	.048*
Team-based Flipped Classroom	59.84	18.17		

Note. *p < .05.

The path diagram revealed that attitude, motivation, and engagement had a significant relationship with each other. Attitude is a weak positive predictor of achievement, $\beta\beta$ = .10, p = .742, while motivation is a weak negative predictor of achievement, $\beta\beta$ = -.15, p = .584. Among the three (3) independent variables, only engagement significantly predicted achievement, $\beta\beta$ = .50, p = .028.

Figure 1

Path Diagram on the Direct Effects of Student Attitude, Motivation, and Engagement on Achievement in a Team-based Flipped Classroom



The qualitative themes generated were (1) Advanced assignments boost self-confidence; (2) Team sharing equates team enjoyment; (3) "We can do it!" Drive; (4) Review online, prepare big time; and (5) Sharing means engaging.

CONCLUSION AND RECOMMENDATIONS

Results revealed that students exposed to TBFC had significantly higher positive attitudes towards mathematics, higher levels of engagement, and higher achievement test scores than CC students. TBFC students also had higher levels of self-confidence, value, and emotional engagement. Among TBFC students, outstanding students showed higher levels of cognitive engagement. Furthermore, the path diagram revealed that attitude, motivation, and engagement are interrelated. Only engagement significantly predicted achievement. Qualitative themes reflected that advanced assignments boost self-confidence, team sharing equates team enjoyment, TBFC has the "we can do it!" drive, reviewing online prepares big time, and sharing means engaging.

Based on the findings of the study, the researcher recommends that the Department of Education may:

- Launch an online educational platform or an offline database in mathematics education where advanced assignment resources can be uploaded;

- Conduct pedagogical training on applying TBFC in blended classrooms; and
- Strengthen programs on instructional material designing using TBFC as a blended approach.

REFERENCES

- Adao, R. M., Bueno, M. B, Persia, J. M., & Landicho, L. C. (2015). Academic motivation among college students with math anxiety: Basis for an enhancement program. *Asia Pacific Journal of Education*, *2*(3), 58 – 62.
- Kennedy, L. (2019). *How attitude towards math impacts student achievement.* Retrieved from https://www.prodigygame.com.
- Kim, H. R., Song, Y., Lindquist, R., & Kang, H. Y. (2016). Effects of team-based learning on problem solving, knowledge and clinical performance of Korean nursing students. *Nurse Education Today, 38,* 115 – 118. https://doi:10.1016/j.nedt.2015.12.003
- River, J., Currie, J., Crawford, T., Betihavas, V., & Randall, S. (2016). A systematic review examining the effectiveness of blending technology with team-based learning. *Nurse Education Today, 45,* 185 – 192. https://doi:10.1016/j.nedt.2016.08.012
- Siegle, D. (2013). Technology: Differentiating instruction by flipping the classroom. *Gifted Child Today, 37* (1), 51 – 55.
- Silao, I. V. (2018). Factors affecting the mathematics problem solving skills of Filipino pupils: A study conducted in Kiamba central school SPED center, Kiamba, Sarangani. *International Journal of Scientific and Research Publications*, *8*(2), 487 – 497.

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