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Survey Research On Chinese STEM Teachers' Teaching Engagement and Its Influencing Factors [2019.3.18 UNT Union Room 333C]



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BACKGROUND &
QUESTIONS



RESEARCH MODEL



DATA & RESULTS



FUTURE STUDY



➤ BACKGROUND & QUESTIONS

The critical role of integrating science, technology, engineering, and mathematics (**STEM**) in fostering students who need to be equipped with 21st century skills has drawn wide attention.

Though started late, the research of **STEM education develops rapidly in our country** and has drawn a lot of attention and interesting of K-12 school leaders and educational institution.

Over the past decade, many educational companies and institutions established to **provide STEM curriculums** for students and support for school teachers, including STEM cloud in Shanghai and Jiangsu province.



BACKGROUND & QUESTIONS

Many K-12 schools **show great enthusiasm on** the education innovation and try to introduce and implement STEM curriculums in order to improve the teaching quality.

Some are selected as **STEM experimental or seed schools** in different areas.

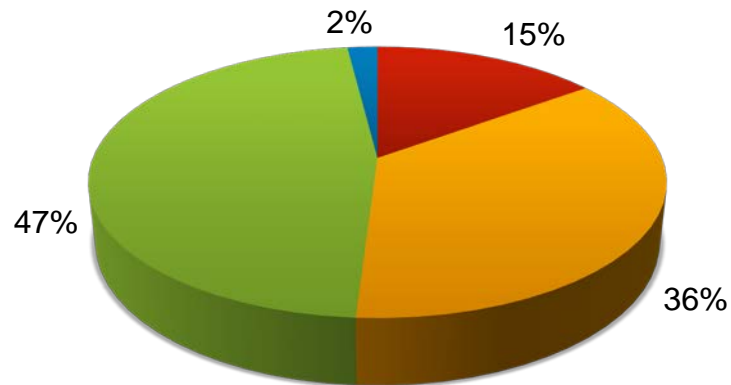


STEM Classroom

BACKGROUND & QUESTIONS

With the rise and popularity of the STEM education campaign in China, **the cultivation of STEM teachers has become the one of the key problem.** Various training programs for STEM teachers were organized all over the country, such as lectures, workshops, seminars, and national conference. **However, there are still many kinds of problems and obstacles that are preventing teachers from implementing STEM education.**

Figure 1. Teachers' self-assessment of their STEM teaching efficiency



■ excellent ■ good ■ medium ■ poor



(Data were from Chinese STEAM Education Development Report)

BACKGROUND & QUESTIONS

Challenges that STEM teachers are facing

Difficulty of teaching method change

Not easy for teachers to **shift from traditional teaching practices to novel teaching practices** that they have not experienced (Brown et al 2011; Toma and Greca 2018).

Lack of interdisciplinary literacy

Teachers need **pedagogical design skills** to design proper classroom environment and inquiry activities which integrating multi-discipline knowledge and skills (Watermeyer and Montgomery 2018).

Lack of engineering knowledge

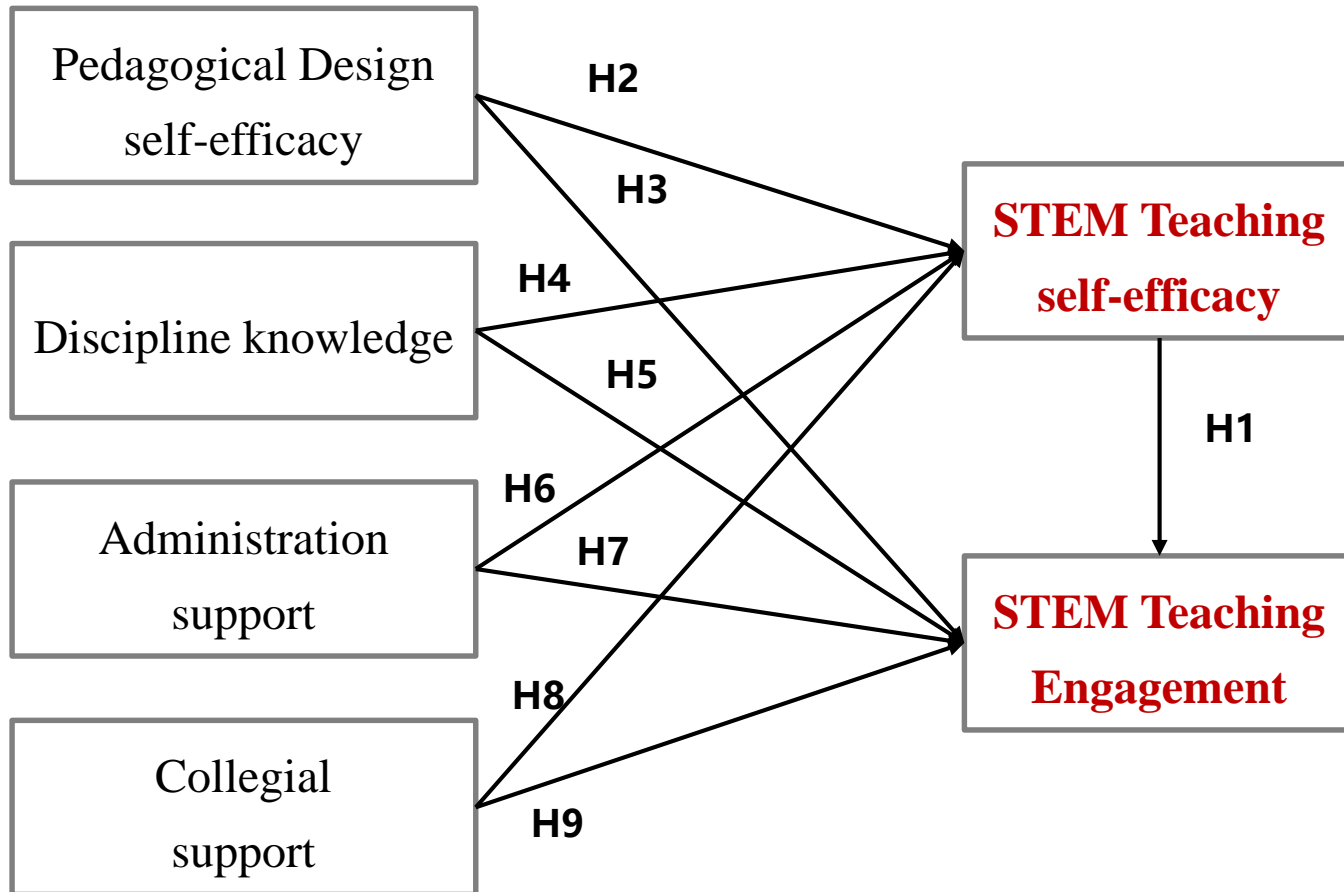
The **discipline-oriented curriculum** prevents teachers from being familiar with other discipline content and most in-service teachers lack engineering knowledge as well (National Research Council 2014).

Insufficient training and support

Unfair or insufficient accessibility to curriculum resources and development opportunities might also result in teachers' lack of confidence and sense of helplessness in STEM teaching (EL-Deghaidy et al. 2017).

Our Research Model

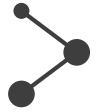
Dong, Y., Xu, C., Song, X., Fu, Q., Chai, C. S., & Huang, Y. (2019). Exploring the Effects of Contextual Factors on In-Service Teachers' Engagement in STEM Teaching. *The Asia-Pacific Education Researcher*, 28(1), 25-34.



Based on the literature review, this study aimed to investigate structural relationships between factors affecting teachers' STEM teaching efficacy and engagement.

Teachers' pedagogical design self-efficacy, discipline knowledge, administration support, and collegial support **were considered as critical factors** influencing teachers' STEM teaching efficacy and engagement.

Figure 3. Hypothesized research model



Data collection

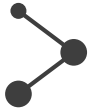
Data were collected from primary, junior, and senior high school teachers, and the schools are mainly located in Zhejiang, Shandong, Guangdong, Jiangsu, Gansu, Henan provinces, and Beijing in China.

458 teachers (Mean age = 34.81, SD = 7.86)

Table 1. Demographic information of the respondents (n=458).

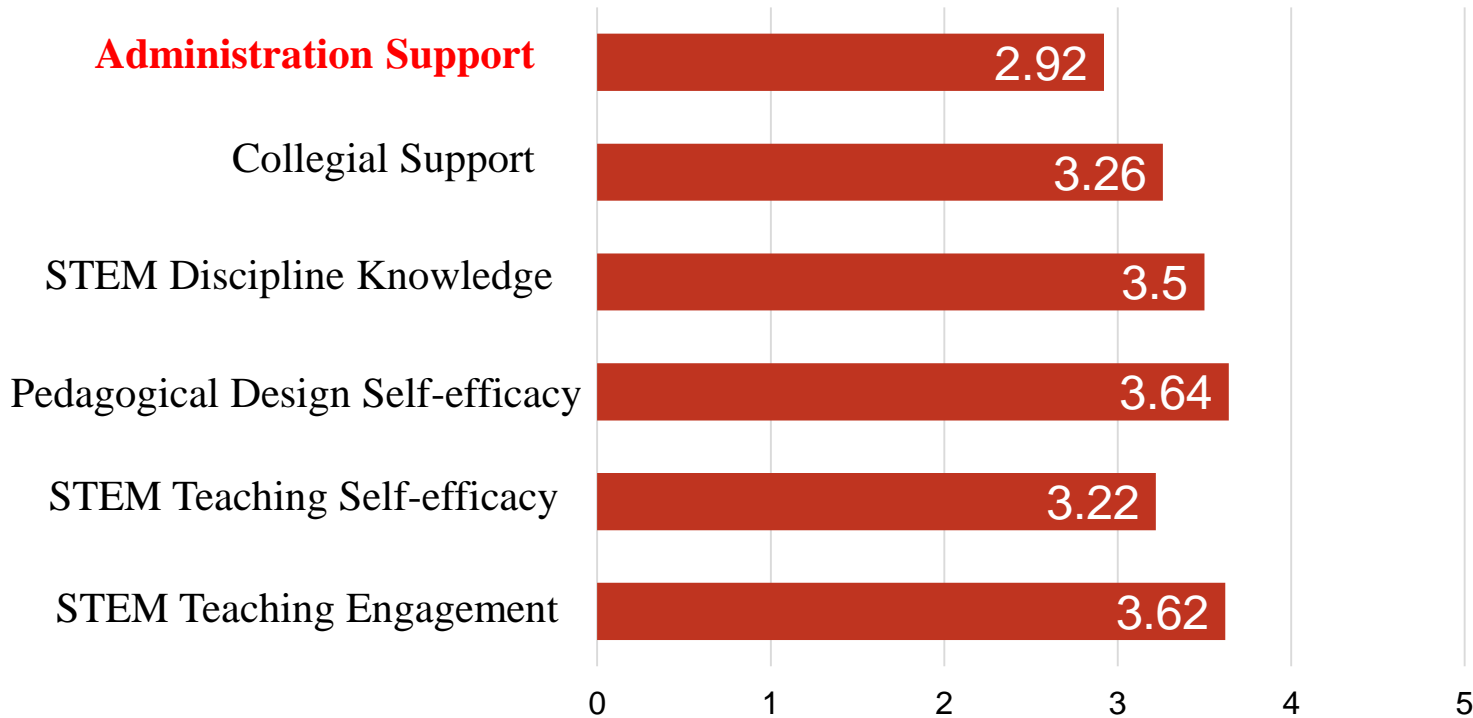
Measure	Options	Frequency	Percentage
Gender	Male	162	35.4%
	Female	296	64.6%
Teaching years	Under 5 years	144	31.4%
	6-15 years	126	27.6%
	16-25 years	142	31.0%
	Over 26 years	46	10.0%
Level of education	High school or below	23	5.0%
	University or college	390	85.2%
	Graduate school or above	45	9.8%
Study phrase	Primary school	348	76.0%
	Junior high school	98	21.4%
	Senior high school	12	2.6%



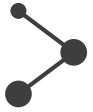


Results

Figure 4. Mean of the five variables



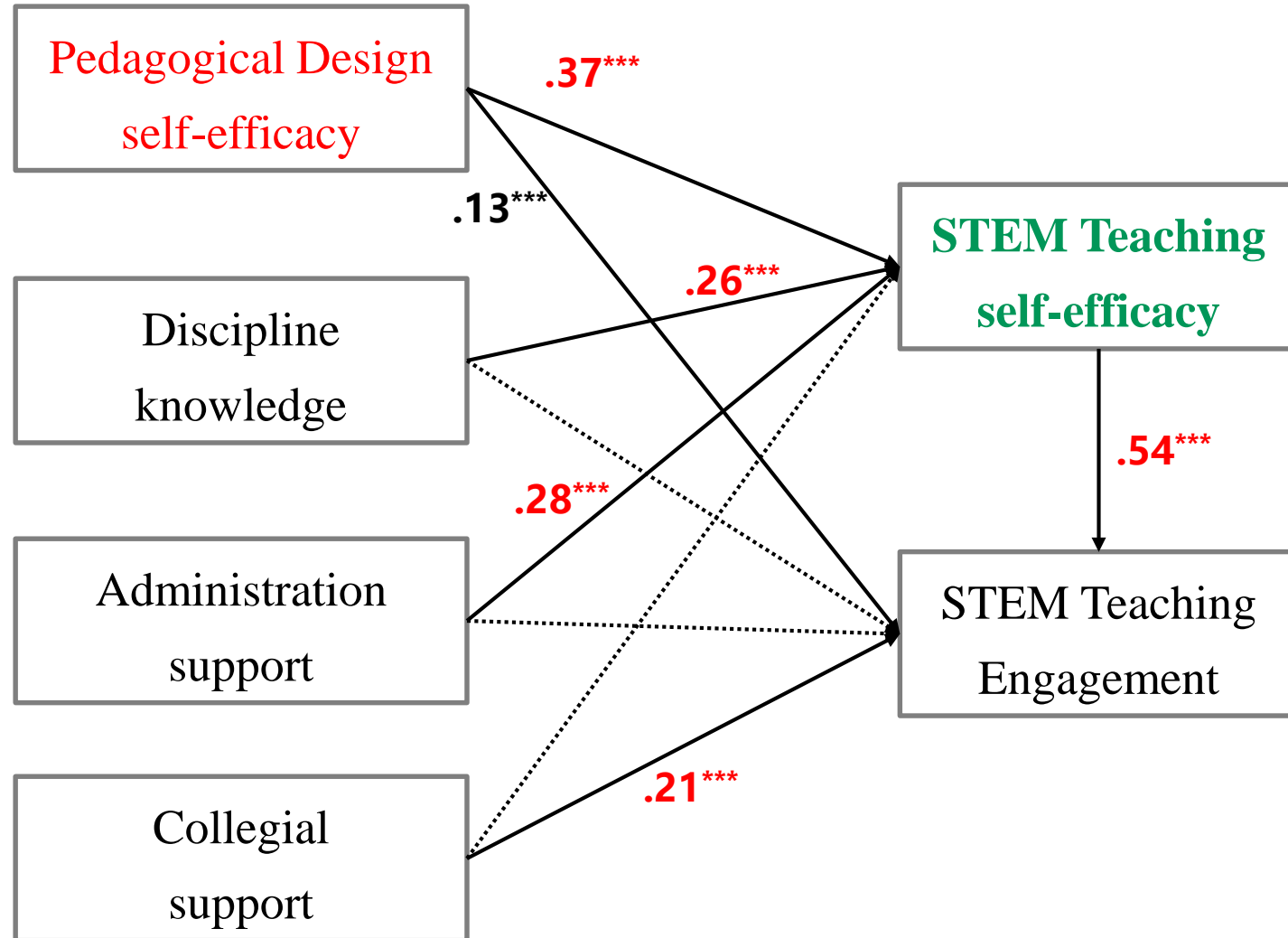
- All the factors are lower than 4.
- **In particular, the administration support is lower than medium.**
- Teachers lack other discipline knowledge.
- Chinese teachers are unconfident on their ability to teach STEM activities.



Results

- (1) teachers' STEM teaching self-efficacy, pedagogical design self-efficacy, and collegial support **have direct positive influence on STEM teaching engagement.**
- (2) Teaching self-efficacy was a robust predictor of STEM engagement with 0.54 path coefficients, which suggested that improving teachers' self-efficacy toward practicing STEM education might contribute fairly to enhancing teachers' engagement in STEM teaching.
- (3) **Pedagogical design self-efficacy** seemed to be the most important predictor for both teaching self-efficacy and STEM teaching engagement.

Figure 5. final model





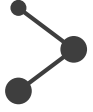
Findings

Previous studies have stressed the importance of lesson design process to teachers' curriculum implementation and pedagogical change (Koh et al. 2017), **identifying design capacity as the potential third order barriers for education reform (Tsai and Chai 2012).**

However, explicit effort in understanding how teachers design circumvent barriers and interact with each other to co-create STEM lesson has apparently not been reported much. **Further research on teacher professional development in the future is needed to observe and examine the process of qualified STEM teachers formulating lesson design**, including selecting multidisciplinary topics, creating inquiry-based learning context, and collaborating with other teachers in the community, etc.

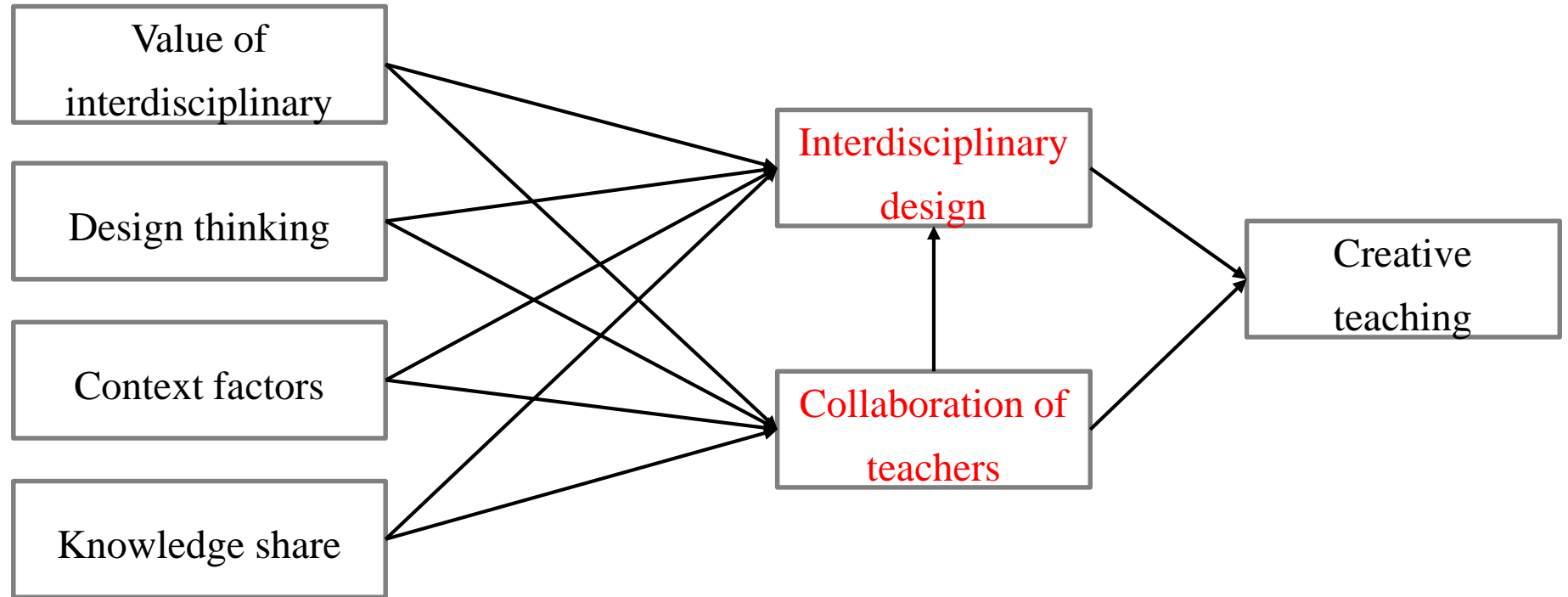
The interdisciplinary feature of STEM education requires collaboration of different subject teachers. More studies are needed to explore how teachers work and how they interact with each other within and across disciplines to develop teachers' collaboration and competencies.

We also suggest further study to **explore the principles and approaches to creating a collaborative and supportive school environment from the angle of school administration.**



Future study

- How to improve STEM teachers' Interdisciplinary design ability in order to enhance their creative teaching ?
- Dose the improvement of collaboration of teachers will enhance teachers' creative teaching?



Suggestions for STEM teacher development

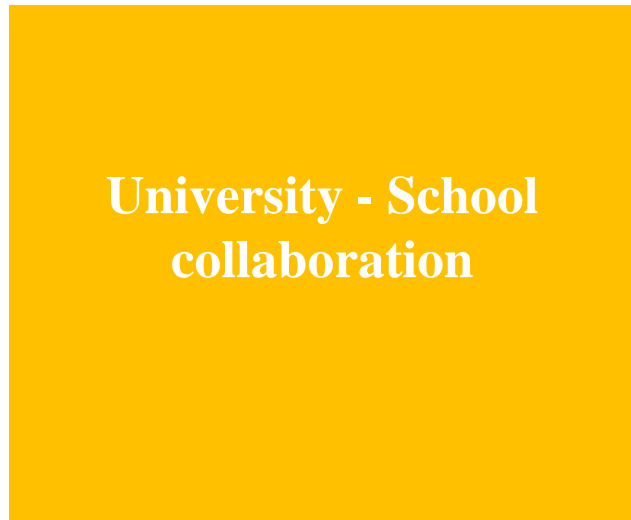
**Teacher
collaboration**



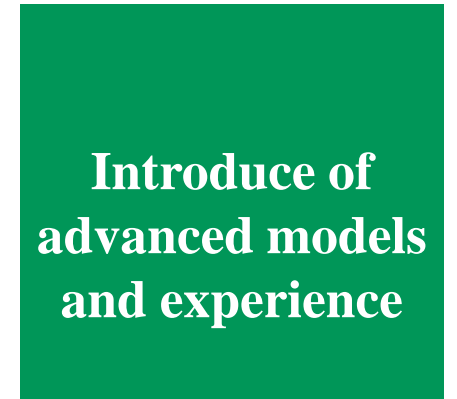
**Policy and
standard**



**University - School
collaboration**



**Introduce of
advanced models
and experience**



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