Middle School Teachers' Self-efficacy in Teaching Computer Science and Digital Literacy

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ABSTRACT

This pilot study explores the impact of the CS Pathways professional development (PD) program on the teachers' self-efficacy in teaching a middle school computer science and digital literacy (CSDL) curriculum. The main goal of the study is to investigate the attributes that describe the teachers' self-efficacy after their first-year participation in the PD. A total of 19 middle school teachers from two states, NY and MA, attended the CS Pathway PD program and completed the end-of-year survey pertaining to self-efficacy in CSDL; more than half accepted the interview to help further understand their perceptions (*n*=10). Principal Component Analysis (PCA) is applied to study the attributes of the teachers' self-efficacy. The preliminary results capture teachers' self-efficacy patterns, which inform the PD and indicate its effectiveness and challenges.

CCS CONCEPTS

• **Social and professional topics → Computing Education**

KEYWORDS

Self-efficacy; Middle School Teachers; Computer Science and Digital Literacy (CSDL); Professional Development

1   INTRODUCTION / PROBLEM

Teachers' self-efficacy is significant since it can predict their behavior and performance [3]. PD has been used as an effective way to enhance teacher's self-efficacy [1]. However, the studies on measuring teachers' self-efficacy in PD programs remain insufficient [2]. Therefore, this study applies multivariate analysis to explore the teachers' self-efficacy in teaching CSDL after attending the CS Pathways project's first year PD program.

The CS Pathways program, with the support of NSF, strives to prepare in-service middle school teachers from three urban-rim school districts in NY and MA to engage their students in both DLCS as they develop apps for social and community good. Preparing teachers to be capable of implementing the curriculum requires strong self-efficacy.

2   METHODS / RESULTS

The survey consists of 23 items, which examine teachers' confidence in three aspects: 1) digital literacy knowledge, 2) app creation, 3) teaching CSDL. The survey asked the participants to rate their confidence in the ability to perform the tasks on a five-point Likert scale. Cronbach's alpha was measured to check the validity and reliability of the set of survey items (Cronbach's alpha = 0.93). The result indicates that the survey items are closely related and valid for self-efficacy assessment. Subsequently, more than half teachers participated in a semi-structured interview. Interviews will be coded to further understand teachers' perceptions on their self-efficacy.

Principal Component Analysis (PCA) is used to study the attributes of the teachers' self-efficacy. It is carried out to explore the salient features that could logically cluster response factors (e.g., survey items) together and explain the correlations to self-efficacy. The three components account for 76.7% of the total variance in the original data. The first Principal Component (PC1) captures teachers with strong confidence and self-efficacy in app creation and teaching CSDL after the PD (PC1 = 43.5%); PC2 indicates that teachers who have relatively less confidence on their digital literacy knowledge gain more confidence in app creation after one year participating in our PD program, however, showing less self-reported capacity in teaching CSDL (PC2 = 20.6%); PC3 represents teachers who evaluate themself as having strong digital literacy knowledge, but very low capacity in teaching CSDL even after participating in the PD (PC3 = 12.7%).

3 IMPLICATIONS AND FUTURE WORK

The major contribution of the paper is that the proposed method goes beyond t-test, which shows the significance of variation in general, to explore the correlations among variables that indicate teachers' self-efficacy patterns and inform PD design. The future study can further investigate whether or not teachers with and without CS background perceive their self-efficacy differently.

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