Walking the Equity, Diversity, and Inclusion Talk: Promoting STEM Teacher Candidates' Views, Understandings, and Implementation of Differentiated Instruction

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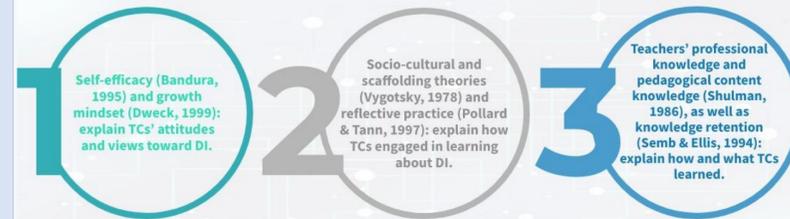
Research Problem and Context

- Canadian schools are hubs for diversity in race, cultural backgrounds, and socioeconomic status.
- Additional variation in students' levels of academic achievement, interests, attitudes, and learning profiles (Tomlinson et al., 2003).
- Ontario's Education Equity Action Plan (2017) aims at strengthening inclusive teaching and providing teachers with professional development focused on equity, diversity, and inclusion (EDI). At the classroom level, differentiated instruction (DI) is a teaching philosophy that has the potential to address student differences (George, 2005).
- Teachers can differentiate the content, process, and product in their lessons (Tomlinson, 1999).
- There is a scarcity of DI applications in STEM secondary education (Maeng, 2017). Additionally, research on DI implementation in Canadian classrooms is limited (Specht et al., 2016). Similarly, there is a dearth of opportunities for training teachers and teacher candidates (TCs) on inclusive teaching strategies such as DI across all Canadian provinces and territories (D'Intino & Wang, 2021).

Research Questions

The study highlights the impact of integrating DI-focused strategies in a course in teacher education at a Canadian university by addressing the following questions:

1. What are intermediate-senior STEM TCs' views and understandings of DI?

2. a) How do TCs develop curricula to be inclusive of DI strategies?

   b) What successes and challenges do TCs encounter when developing DI focused curriculum?

   c) What models of technology-enhanced DI do TCs incorporate in their lessons?

3. How do TCs implement DI in their practicum?

4. What are TCs' intentions, in terms of integrating DI in their future careers?

Theoretical Framework

1. Self-efficacy (Bandura, 1995) and growth mindset (Dweck, 1999): explain TCs' attitudes and views toward DI.

2. Socio-cultural and scaffolding theories (Vygotsky, 1978) and reflective practice (Pollard & Tann, 1997): explain how TCs engaged in learning about DI.

3. Teachers' professional knowledge and pedagogical content knowledge (Shulman, 1986), as well as knowledge retention (Semb & Ellis, 1994): explain how and what TCs learned.

Research Methodology

- The study adopted a mixed method approach (Creswell & Creswell, 2018), specifically a case study (Yin, 2014).
- It involved 19 intermediate/senior TCs in a Year-2 curriculum and pedagogy course in STEM education in a teacher education program at a university in Ontario.
- DI principles and strategies were integrated using an explicit and reflective approach (Abd-El-Khalick & Lederman, 2000).
- The instructor provided the TCs with course readings, resources, and feedback to integrate DI in their three major curriculum development projects: 1) creating case studies around socio-scientific issues (SSI), 2) developing digital video games (DVGs), and 3) creating digital curriculum resources websites.
- Both quantitative and qualitative data were collected utilizing: 1) pre- and post-course questionnaires exploring TCs' views, understandings, and implementation of DI; 2) semi-structured interviews and post-practicum open-ended survey detailing TCs' implementation of DI in the course and in their practicum; and 3) TCs' course work analysis, including the three major assignments and TCs' reflections, lesson plans, and peer evaluation.
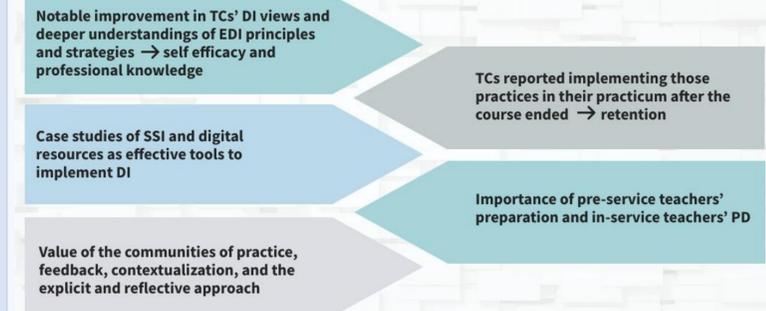
Data Analysis

- Quantitative data from the questionnaires were analyzed by performing descriptive statistics using Microsoft Excel and statistical tests using SPSS.
- The qualitative data from open-ended survey questions and interviews were analyzed using an inductive process (Creswell & Creswell, 2018).
- The coursework analysis was conducted using a deductive process according to developed frameworks suitable for each assignment, exploring how TCs differentiated the content, process, and products in their curriculum.
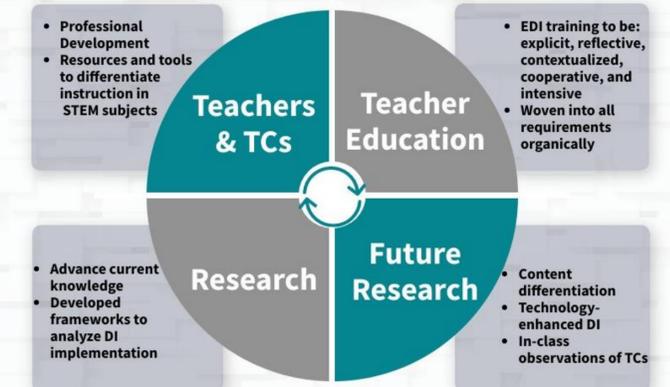
Findings

- The course resulted in a notable improvement in TCs' DI views and deeper understandings of EDI principles and strategies. TCs also reported implementing those practices in their practicum after the course ended, indicating retention of the acquired knowledge and skills.
- TCs reflected on what they considered most valuable in terms of their preparation, such as participating in communities of practice, feedback they received, and contextualized practical application of EDI-related principles learnt. These findings reiterate the importance of opportunities aimed at enhancing teachers' and TCs' preparation to integrate DI in their practices (e.g., Dack, 2018; Goodnough, 2010).
- The SSI case studies task was successful in promoting TCs' curriculum development while attending to DI principles and practices.
- TCs created educative curriculum materials (ECMs) that are both DI-focused and digitally enriched. Thus, technology has the potential to enhance DI by facilitating pacing variation for different students, presenting the content in different formats, integrating multimodalities, utilizing engaging technological solutions, and by facilitating different forms of assessment.

Conclusions

Notable improvement in TCs' DI views and deeper understandings of EDI principles and strategies → self efficacy and professional knowledge

TCs reported implementing those practices in their practicum after the course ended → retention

Case studies of SSI and digital resources as effective tools to implement DI

Importance of pre-service teachers' preparation and in-service teachers' PD

Value of the communities of practice, feedback, contextualization, and the explicit and reflective approach

Implications

Teachers & TCs
- Professional Development
- Resources and tools to differentiate instruction in STEM subjects

Teacher Education
- EDI training to be: explicit, reflective, contextualized, cooperative, and intensive
- Woven into all requirements organically

Research
- Advance current knowledge
- Developed frameworks to analyze DI implementation

Future Research
- Content differentiation
- Technology-enhanced DI
- In-class observations of TCs

References

Please click here for the reference list.

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