Pathways to Innovative Teaching Practices in Korean Secondary Multiethnic Classrooms: Through Lens of Complex Causality

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ABSTRACT

The under-achievement and school dropout of students from multiethnic backgrounds are becoming a paramount social concern. Research on innovative teaching practice (ITP) and its relationship with student engagement highlight teachers' need to implement innovative teaching for quality education for all, sustainable development goal 4 (SDG4). This research started from the premise that ITP is a social phenomenon characterized by its causal complexity. Based on this framework, the purpose of this research is to reveal the different combinations of conditions leading to innovative teaching practices in Korean secondary multiethnic classrooms and to suggest implications for promoting inclusive and quality education for all. Against this backdrop, the research questions are: 1) which conditions are necessary to ITP in Korean secondary multiethnic classrooms? 2) Which conditions or combination of conditions are usually sufficient for ITP in Korean secondary multiethnic classrooms? The research method is the fuzzy sets qualitative comparative analysis (fsQCA), which starts from the premise that social phenomena have causal complexity characteristics and use the set-theoretic relations. The analysis tool is the fsQCA 2.5 software. This study's data were derived from the 2018 Teaching and Learning International Survey (TALIS) conducted by the OECD. This study was based on a sample of 194 Korean secondary teachers. The outcome variable is innovative teaching practices (ITP), and the causal variables were teacher efficacy in general (TGE), teacher self-efficacy in multicultural classrooms (TME), teachers' innovative climate (TI), and social utility motive to become a teacher (SUM). The results were the following. 1) None of the conditions met the threshold for necessary conditions (0.90). 2) Three distinct pathways to high ITP and two different paths to low ITP were produced. 3) Either high multicultural efficacy or high general efficacy turned out to be the core condition for high ITP, but neither condition is sufficient by itself. These core conditions have to be combined with other factors, including innovative teachers' climate and strong social value motive to become a teacher. 4) In the two pathways to produce the low level of ITP, both the low level of teacher multicultural efficacy and teacher general efficacy are core conditions. This research includes practical implications for promoting sustainable development goal 4 (SDG 4), the inclusive and quality education for all.

Introduction

As reported by the Korean Ministry of Education, 137.225 ethnically diverse population enrolled in elementary and secondary schools in 2019. This number indicates a threefold increase in total multicultural students in the last eight years [1]. With the rapid multicultural population increase, the students from multiethnic backgrounds continue to face prejudice and discrimination by mainstream students because they look different than native Korean students [2.3]. A few students from multiethnic backgrounds consistently achieve below average, with a further widening of the gap between students' learning achievement from multiethnic backgrounds and mainstream students and the increase in the dropout among multiethnic students. The dropout rate among secondary school students from multiethnic backgrounds is 4.5 times as many as mainstream students [4].

Prior research [5-7] revealed that secondary multicultural students' disengagement in class and prejudice, discrimination, and alienation by peer mainstream group places them at increased risk of academic failure and school dropout. Multicultural students are positioned in biased educational conditions where their learning opportunities are reduced in Korea [8].

How do Korean secondary school teachers achieve and sustain their success in ensuring quality education for all students regardless of their ethnicity, gender, and social status? Strategies such as student-centered learning, learning through case-studies, inquiry-oriented learning, and learning in groups are potential solutions to achievement problems among multiethnic students and prejudice, which can be denoted as innovative teaching practices. The innovative teaching strategies have been recommended as a way for a teacher to embrace and make their teaching way more exciting and to facilitate their student engagement [9-12]. Therefore, it is worth considering innovative teaching strategies to promote inclusive and quality education for all, sustainable development goal 4 (SDG 4).

So, even if innovative teaching practice is not commonplace in Korea, what conditions reach a desired level of accomplishment? In this regard, understanding the complexity of innovative teaching is the critical step for improving the quality of teaching practice in Korean secondary multiethnic classrooms. Innovative teaching practices are social phenomena characterized by their causal complexity, which are defined as conjunctural causation, equifinality, and causal asymmetry [13]. Therefore, innovative teaching practices in Korean secondary multiethnic classrooms rarely have any single factor, and whose factors interact in multiple ways and rarely work in isolation from each other.

Due to such causal complexity of innovative teaching, there is a need to use methodological approaches to reveal its antecedents' complex interactions. One alternative method to assess equifinal causal structures is fuzzy sets qualitative comparative analysis (fsQCA) using set theory [14-17]. fsQCA conceptualizes causality in terms of necessity and sufficiency, which show different paths as alternatives for an outcome [15]. fsQCA takes this aspect of causal complexity

into account by performing separate analyses for necessary and sufficient conditions in which conjunctural causal conditions are explicitly permitted and examined. This method opens the possibility for conjunctural causation, equifinal causal structures, and causal asymmetry [17].

Therefore, fsQCA is suitable for revealing the complex nature of innovative instructional practice as the interplay of different factors and allow for a complete understanding of the complex interdependencies among factors that promote the innovative teaching practices. However, little study has systematically identified and compared such combinations of conditions (or pathways) producing innovative teaching practices in Korean secondary multiethnic classrooms. Instead, previous researchers have used the regression analysis that usually focuses on each independent variable's effect on innovative teaching. In contrast, the level of the rest independent variables is controlled. Furthermore, in the regression model, the high degree of correlation between independent variables may result in the parameters' linear combination. It becomes difficult to estimate the relationship between each independent variable and the dependent variable independently [18]. The high degree of correlation between independent variables is considered a problem of multicollinearity in a regression model.

In this respect, fsQCA can be a better alternative methodology for analyzing innovative teaching practices in multicultural classroom settings since fsQCA using a set-theoretic method starts from the premise that social phenomena have causal complexity characteristics. Therefore, the author tried to explore combinations of factors leading to innovative teaching practices in Korean secondary multiethnic classrooms, using fsQCA through the lens of complexity framework. The purpose of this research is to increase an understanding of combinations of factors leading to innovative teaching practices in Korean secondary multiethnic classrooms and to suggest implications for promoting inclusive and quality education for all, sustainable development goal 4 (SDG 4). Regarding this dual purpose, the following two research questions were addressed:

· Which conditions are necessary for innovative teaching in Korean secondary multiethnic classrooms?

· Which conditions or combination of conditions are usually sufficient for innovative teaching in Korean secondary multiethnic classrooms?

Literature Review

This section reviewed the related theories and frameworks to understand innovative teaching practices in multicultural classroom settings and innovative teacher education strategies. Specifically, The author closely examined the core constructs under investigation: innovative teaching practices, their critical factors, and review prior research on their relations.

Innovative teaching in Korean classrooms

Just as the successful introduction of something new can be denoted the word 'innovation' [19], educational innovation can also approach as a new pedagogical theory, teaching method, learning process, assessment method, or institutional structure that produces a significant change in teaching and learning.

According to Mandela and his colleagues [20], innovative teaching involves using innovative methods and teaching materials for students' benefit, which refers to student-centered teaching practices and integrated with real-world problems and exercises.

KICE (Korea Institute for Curriculum and Evaluation) defined innovative Korean teaching as a student-oriented and problem-centered teaching practices as opposed to passively watching, listening, and reading through Delphi survey and in-depth interview of professionals from nationwide and outside regarding the conceptualization of 'Korean innovative teaching practice' [21]. Hence, Korean innovative teaching practices focus on the learning activities in which learners are actively involved in the process of meaning. Students engage with the unstructured task, problems, or issues that perform critical analysis, problem-solving, and decision making rather than passively receiving information. Collaborative learning, inquiry learning, discussion learning, PBL (project-based learning, problem-based learning), teaching through flipping classrooms, integrated class, Havruta class, teaching through artificial intelligence, teaching through virtual reality, and so on are included in innovation.

Empirical evidence [22-25] have consistently shown that inquiry-based learning, PBL, and collaborative learning make students participate in learning with greater motivation to complete their task or problems. Also, innovative teaching practices help different ethnic students make friendly interactions, and students enhance their development of social skills and increase their self-confidence. Therefore, innovative teaching leads to quality education for all, regardless of gender, social status, and ethnicity. A review of the research implies that innovative teaching practice can be an excellent way to foster inclusiveness, increase student engagement in Korean multiethnic classrooms, and serve as an entryway into more in-depth interactions between secondary school students from multiethnic backgrounds and their peers.

Factors influencing Innovative teaching

The social cognition theory is the theory that tries to explain people's behavior through a framework of the triadic reciprocal determinism model, representing bidirectional relationships among an individual's behavior, personal factors, and the environment. Above all, self-efficacy, a social cognitive theory component, is a critical teaching practice factor [26]. Social cognitive theory, which has been widely used to explain people's behavior, is also helpful in understanding teaching practice. Thus, the social cognitive theory was used as a lens exploring combinations of factors leading to innovative teaching practices in Korean secondary multiethnic classrooms.

By the way, it is worth noting that teaching practice is a behavior to achieve a goal. Goals serve as a standard for action and allow the individual to give attention to a particular task, exercise appropriate strategies, and reflect performance outcomes. Goal setting has a relationship with efficacy and the imagined visions of oneself in the future, which can be approached as the theory of possible selves [27]. Empirical evidence [28-31] shows that the social utility motive for becoming a teacher has been reported to be related to innovative teaching practices. Therefore, the theory of possible selves helps better to understand innovative teaching

practices in Korean multiethnic classrooms. The view of possible selves was adopted as an additional theoretical framework analyzing combinations of factors leading to innovative teaching practices in Korean secondary multiethnic classrooms.

Social cognitive theory

In social cognitive theory, humans are self-reactors with a capacity for self-direction. Human behavior is shaped by the inter-relationship of personal factors such as cognition, biological events, and environmental influences based on Bandura's conception of reciprocal determination. Reciprocal determination is the viewpoint that personal factors, behavior, and environmental influences create an interface that results in triadic reciprocity. Reciprocity provides opportunities for and simultaneously sets restrictions on individual self-direction for action. However, this action is guided by the individual's agency and governed by their self-efficacy [32].

Self-efficacy, a person's beliefs in their capability to engage in the course of action required to accomplish a given end state, is one of the most substantial factors that drive one's motivation in social cognitive theory [32]. Efficacy plays a crucial role in human functioning because it directly affects behavior and its impact on other determinants such as goals and aspirations, outcome expectations, and the perception of impediments and opportunities in the social environment. Therefore, it is seen as having a direct bearing on the choice of activities and effort expenditure. Self-efficacy influences the courses of action people choose to pursue, how much effort they put forth in given endeavors, how long they will persevere in the face of obstacles and failures. When one believes that he/she is competent to accomplish a task, they are more motivated to engage in and complete the task.

Likewise, in the educational context, teachers' efficacy, the belief in their ability to bring about desired learning outcomes in their students, is a significant source of motivation and commitment in all aspects of teaching practices and has been directly related to many educational products. Prior studies [33-35] have shown that, compared to low-efficacy teachers, the high-efficacy teachers were more likely to implement innovative teaching or try new ideas or teaching strategies to meet their students' learning needs better. Highly efficacious teachers have more persistence when helping struggling students, and they create lessons designed to engage their students [32]. Teachers with higher self-efficacy report more effective instructional strategies [36] and seem to implement innovations more efficiently [37].

Tschannen-Moran and Woolfolk Hoy [38] developed the teacher self-efficacy scale (TSES) to measure teachers' sense of self-efficacy regarding teaching tasks involved in student engagement, classroom management, and instructional practices. Vesely et al. [39] referred to this as teacher general efficacy, which is the professional competency and characteristics required for optimal classroom effectiveness and with students generally.

Teacher self-efficacy must be considered behaviors specific to the situations in which the teacher believes in his/her ability to help students succeed because self-efficacy is context-specific drawn from the interaction of behavior, individual characteristics, and environmental contexts [32, 40, 41]. Teacher general efficacy alone can not be enough to implement innovative teaching practices in multicultural classrooms. The multicultural efficacy, a teacher's belief on how well they can teach students in a multicultural classroom context, can be crucial to better implement innovative teaching practice in multicultural classrooms. Empirical studies [42, 43, 44] have reported that teachers with higher multicultural efficacy focus more on multicultural content and consider students' social and cultural backgrounds when designing lesson plans.

Based on the social cognitive theory, the teachers′ climate directly or indirectly impacts teaching practices. The teacher culture is the set of norms, values, and beliefs that resides within a school and guides teachers' behavior. Because a teacher culture influences visions and values that teachers hold about teaching and learning, innovative teaching happens more in schools with a teachers′ climate that supports innovation. When the teams work effectively, the school organizational culture can make smooth changes, integrating and transforming school teaching and guidance to enhance students' learning [45]. McCharen and colleagues [46] note that organizational innovation is critically linked to the learning organization's cultural aspects. The OECD recommended stimulating a supportive school climate and learning environment as an effective method for improvement in low-performing disadvantaged schools [47].

The theory of possible selves

Markus and Nurius suggested the theory of possible selves to refer to what one perceives as potentially possible concerning oneself regarding future-projected aspects of self-knowledge. The possible selves are categorized into three types; 1) hoped-for selves (selves that one would very much like to become), 2) expected selves (selves that one could become), 3) feared selves (selves that one is afraid of becoming), which provide rich information about what people envision as their hoped-for future, and what strategies they have to attain their hoped-for possible selves [27].

The hoped-for selves may be said to be imagined visions of oneself in the future, which is a positive vision of selves drawing on hopes and an individual's affective experience in that desired future state [48, 49,50]. Since the hoped-for is the positive future reference for the actual self, the hoped-for selves contain the properties that one would ideally like to possess and aspires to attain.

The possible selves constitute the context for evaluating the actual self, and thus they are an essential element of self-evaluation processes. The subjective evaluation of the current state of the self must take into account some point of reference. This specific potential state is a criterion in evaluating the current state [48]. The possible selves also function as a motivational link between motives and particular actions because they motivate the person to take action to realize the hoped-for visions of the self [30]. Erikson [49] suggested that only possible selves meaningful to the individual would likely influence behavior regulation. Fletcher [51] describes how teachers' possible selves can be transformative by imagining a specific goal for oneself as a teacher in the future and by the motivational benefit of striving to become what one values and anticipates.

One of the central features of possible selves is precisely

their function of standards in self-regulation and behavior change. The possible selves play a self-standard role or a criterion in evaluating the actual selves [50]. Besides, the possible selves help one focus on goals and serve as a factor for achieving a specific goal by giving a scheme to the desired goals, the associated plans for achieving them, and the values associated with them. Hoyle and Sherrill [50] further demonstrated that the self-regulative effect of possible selves is influenced by the time frame used to consider the future-oriented selves. If possible selves influence self-evaluation processes and play an important role in peoples' behavior, it seems reasonable to assume their role in implementing innovative teaching practices. Teacher motive to choose teaching as a career may be a possible self.

Teacher motive to choose teaching as a career was approached by the personal utility and social utility motives. The personal and social utility value constructs represent the extent to which a person chooses teaching based on how eaching affects one's personal life and how they will contribute to society. Personal utility motives include job guarantee, income, job security, and social utility motives, including the service of people and society, precisely, the development of children and young people, a benefit for the socially disadvantaged, and contribution to society. Therefore, social utility value refers to altruistic motivations, including enhancing social equity and making a social contribution. The prior researcher reported that not all motives contribute equally to social functioning, but social utility motives are more beneficial for social functioning [52-54].

Methods

Data Collecting

This research's data were taken from the 2018 Teaching and Learning International Survey (TALIS) conducted by the Organization for Economic Cooperation and Development. TALIS data set was downloaded from http://www.oecd.org/education/talis/talis-2018-data.htm. The latest international large-scale database containing a nationally representative sample of teachers, TALIS 2018, was released for public use on 4. December, 2019 [55]. It is essential to use the most updated data to identify the educational phenomena associated with teachers' instructional beliefs and practices. TALIS sampling is a stratified two-stage probability sampling design and contains nationally representative samples of teachers. The TALIS 2018 framework addresses general pedagogical practices at the institutional and individual levels and emerging themes related to innovation and teaching in diverse environments and settings. TALIS 2018 addresses teacher multicultural efficacy, a separate scale titled teacher self-efficacy in multicultural classrooms, which is meaningful in that measures of self efficacy must allow for the context in which behaviors occur.[56] After eliminating cases with missing performance information, the 194 teachers were selected as the valid sample for this research. The more detailed demographic information of in-service teachers is displayed in Table 1.

Table 1. Teacher Demographics

Characteristics		Respondents	
Gender	Female	147	75.8
	Male	47	24.2
Year of teaching experience in total	until five year	41	21.1
	6 ~ 10 year	28	14.4
	11 ~ 15 year	26	13.4
	16 ~ 20 year	35	18.0
	21 ~ 25 year	22	11.3
	26 year or over	42	21.6
Highest level of formal education completed	Bachelor's or equivalent level	120	61.9
	Master′s or equivalent level	74	38.1
The primary subject category of the target class	Reading, writing, and literature	36	18.6
	Mathematics	19	9.8
	☐ Science	20	10.3
	☐ Social studies	31	16.0
	Modern foreign languages	21	10.8
	Technology	10	5.2
	Arts	15	7.7
	Physical education	12	6.2
	Religion or ethics	9	4.6
	Practical and vocational skills	11	5.7
	☐ Other	10	5.2
Courses taking in teacher education	Content of the subject	187	96.4
	Pedagogy of the subject	179	92.3
	General pedagogy	180	92.8
	Classroom practice in the subject	177	91.2
	Teaching in a mixed ability setting	125	64.4
	Teaching in a multicultural or multilingual setting	67	34.5
	Teaching cross-curricular skills	136	70.1
	Use of ICT for teaching	128	66.0
	Student behavior and classroom management	132	68.0
	Monitoring students development and learning	130	67.0
Topics participating in professional development	Knowledge and understanding of the subject	183	94.3
	Pedagogical competencies in the teaching subject	180	92.8
	Knowledge of the curriculum	161	83.0
	Student evaluation and assessment practices	162	83.5
	ICT skills for teaching	128	66.0
	Student behavior and classroom management	150	77.3
	School management and administration	93	47.9
	Approaches to individualized learning	129	66.5

Teaching students with special needs	68	35.1
Teaching in a multicultural or multilingual setting	98	50.5
Teaching cross-curricular skills	149	76.8
Analysis and use of student assessments	150	77.3
Communicating with people from a different culture	69	35.6

Variables and Measurement Instrument

This research aims to explore combinations of factors leading to innovative teaching practices in Korean secondary multiethnic classrooms. Teaching practice is not determined just by the teacher′s background, efficacy, and motives but also by school-level context variables such as the school′s principal leadership, teacher cooperative professional development, and teachers′ climate. This research focused on whether innovative teaching practices adapt to teacherefficacy in general (TGE), teacher self-efficacy in multicultural classrooms (TME), teachers' innovative climate(TI), and social utility motivation to become a teacher (TM) due to the limitation of the available dataset. The outcome variable (dependent variables) is innovative teaching practices (ITP). The causal variables were teacher efficacy in general (TGE), teacher self-efficacy in multicultural classrooms (TME), teachers' innovative climate (TI), and social utility motivation to become a teacher (SUM).

Outcome Variable

Teaching practices included thirteen items in TALIS 2018, which were estimated on a 4-point scale. Of these thirteen items, I selected seven items that describe innovative teaching practices emphasizing student-centered activities based on tasks or projects and cooperation among students, compared to the traditional lecture-centered reaching [9, 19, 58, 59]. Recently, integrating and using ICT in the classroom allows constructing an enhanced learning environment through interactive and collaborative tools. ICT Based learning was included as an item of innovative teaching practices.

Factor analysis was conducted to evaluate how well the actual empirical data reflected the predefined latent construct. First of all, seven items related to innovative teaching practices were subjected to exploratory factor analysis followed by the principal axis factoring technique using a varimax rotation with an eigenvalue greater than 1. Exploratory factor analysis initially produced one item with communalities less than 0.50 (I refer to a problem from everyday life or work to demonstrate why new knowledge is useful), and it was removed. Exploratory factor analysis with six items produced a single factor, which accounted for 58.87% of the total variance. It can be considered a solution that accounts for 56.6 percent of the total variance (and in some instances even less) to be satisfactory [60]. Therefore, the cumulative variance criterion was met.

Confirmatory factor analysis (CFA) was also conducted to approve the construct validity of items further. The construct validity was tested by composite reliability (CR) and the average variance extracted (AVE) indices to assess the convergent validity. When AVE is more than 0.50, it is considered acceptable, and when CR is 0.7 and above, it is considered acceptable [61]. The standardized regression estimate of six items was more than 0.5, and the convergent validity based on factor loading, AVE (0.51), and CR (0.86), were met. Cronbach's alpha for scale ′innovative teaching practices′ presented in table 2 is above 0.70.

Causal Variables

The teacher general efficacy was assessed using thirteen items to cover the three factors (self-efficacy in instruction, classroom management, and student engagement). However, these did not be reproduced through exploratory factor analysis; instead, exploratory factor analysis extracted a single factor, which accounted for 64.78% of the variance. A confirmatory factor analysis failed to produce theoretically meaningful or discriminable three factors. One composite factor measuring teacher self-efficacy was used as a variable for analysis. The standardized regression estimate of thirteen items was more than 0.5 (0.75~0.93), and the convergent validity (AVE: 0.73, CR: 0.97) met the criteria. Cronbach′s α coefficient (0.95) indicated very high internal consistency reliability.

Teacher multicultural efficacy was assessed using five items. Exploratory factor analysis applying the principal axis factoring technique with a varimax rotation produced a single factor, which accounted for 74.62% of the variance. The standardized regression estimate of thirteen items was more than 0.5 (0.69~0.96), and the convergent validity (AVE: 0.69, CR: 0.90) met the criteria. Cronbach′s α coefficient (0.91) indicated very high internal consistency reliability.

Teachers′ innovative climate was assessed using four items. Exploratory factor analysis produced a single factor, which was accounted for 79.84% of the variance. The standardized regression estimate of thirteen items was more than 0.90, and the convergent validity (AVE: 0.87, CR: 0.96) met the criteria. Cronbach′s α coefficient (0.91) indicated very high internal consistency reliability.

Teacher motivation to become a teacher as a career was measured by seven items concerning the two subscales: personal utility motivation to teach and social utility motivation. Social utility motivation affects innovative instructional practice in multiethnic classrooms, and social utility motivation was selected as a variable. Exploratory factor analysis produced a single factor, which accounted for 78.88% of the variance. The standardized regression estimate of thirteen items was more than 0.65, and the convergent validity (AVE: 0.69, CR: 0.87) met the criteria. Cronbach′s α

value is 0.86. Table 2 presents variables, measured items, the scale, and Cronbach′s α reliability coefficient values.

Table 2. Variables and Measurement

Variable	Measured items	CR	AVE	Cronbach′s α
Innovative teaching practices (ITP)	How often do you do the following? I present tasks for which there is no obvious solution. I give tasks that require students to think critically. I have students work in small groups to come up with a joint solution to a problem or task I ask students to decide on their own procedures for solving complex task I give students work on projects that require at least one week to complete. I let students use ICT (information and communication technology) for projects or classwork.	0.86	0.51	0.86
Teacher general Efficacy (TGE)	In your teaching, to what extent can you do the following? Get students to believe they can do well in school work Help students value learning Craft good questions for students Control disruptive behavior in the classroom Motivate students who show low interest in school work Make my expectations about student behavior clear Help students think critically Get students to follow classroom rules Calm a student who is disruptive or noisy Use a variety of assessment strategies Provide an alternative explanation, for example when students are confused Vary instructional strategies in my classroom Support student learning through the use of digital technology (e.g. computers, tablets, smartboards)	0.97	0.73	0.95
Teacher multicultural Efficacy (TME)	In teaching a culturally diverse class, to what extent can you do the following? Cope with the challenges of a multicultural classroom Adapt my teaching to the cultural diversity of students Ensure that students with and without a migrant background work together Raise awareness for cultural differences amongst students Reduce ethnic stereotyping amongst students.	0.90	0.69,	0.91
Teachers′ innovative climate (TI)	Thinking about the teachers in this school, how strongly do you agree or disagree with the following statements? Most teachers in this school strive to develop new ideas for teaching and learning. Most teachers in this school are open to change. Most teachers in this school search for new ways to solve problems. Most teachers in this school provide practical support to each other for the application of new ideas.	0.96	0.87	0.91
Social utility motive to become a teacher (SUM)	How important were the following for you to become a teacher? Teaching allowed me to influence the development of children and young people. Teaching allowed me to benefit the socially disadvantaged. Teaching allowed me to provide a contribution to society.	0.87	0.69	0.86

Analysis Method and Analysis Tools

This study was used fsQCA using a set-theoretic method. fsQCA starts from the premise that social phenomena have causal complexity characteristics, which are defined as conjunctural causation, equifinality, and causal asymmetry.

However, conventional statistical methods cannot achieve causally complex results as they cannot explain the form of causal complexity that comes with it. Instead, fsQCA can account for investigating the complex interdependencies among factors that produce innovative teaching practices.

fsQCA used the set-theoretic relations such as sufficiency

and necessity. Set-theoretic methods can systematically and formally examine the necessary and sufficient conditions for the outcome. A cause is necessary if it must be present for a specific outcome to occur. A cause is defined as sufficient if by itself it can produce a specific outcome [15, 17].

fsQCA evaluates necessity and sufficiency relations through consistency and coverage), which serve similar purposes of significance and effect sizes in regression analysis. Consistency measures the proportion of members of the subset that are members of the superset. The higher the consistency is, the stronger the set relationship is. Coverage gauges a configuration's empirical relevance or importance [15].

In assessing causal sufficiency, fsQCA employs the probabilistic concept of quasi sufficiency wherein sufficiency is evaluated based on specific benchmarks. A causal condition can be almost always sufficient (significantly passing a standard of 0.8), usually sufficient (significantly passing a standard of 0.65), or sufficient more often than not (significantly passing a standard of 0.50) in causing the outcome [15].

Descriptive analyses, exploratory factor analysis, and reliability analysis were conducted SPPS Statistics version 25.0 for Windows. Confirmatory factor analysis was carried out using the AMOS 26.0, and convergent validity analysis (AVE and CR) was performed using the construct calculator. This calculator was downloaded from https://blog.naver.com/PostView.nhn?blogId=5minstat&logNo=221441325233. The fsQCA software version 2.5 for Windows was used as an analysis tool for fsQCA.

Results

Distribution of teachers' response

A descriptive analysis was conducted to examine the distribution of teachers' responses. A fuzzy-set scales degree of membership ranges from a score of 0 (full exclusion) to 1 (full inclusion). All conditions must be transformed into calibrated sets using three qualitative anchors. Three anchors included the threshold for full membership (fuzzy score =0.95), the threshold for full non-membership (fuzzy score = 0.05), and the cross-over point (fuzzy score = 0.5) [15]. These three anchors need to be based on theoretical and substantive knowledge of the cases. Since there are no explicit external standards for calibration, the threshold values were determined using the sample's existing distribution.

All indicators were normalized into the (0－1) range using the min-max normalization method. The normalization is beneficial because several of the variables do not contain many members at high degrees. The threshold for full membership (fuzzy score =0.95) was set at 0.8, and the threshold for full non-membership (fuzzy score = 0.05) was set at 0.2. The cross-over point was set at about the 50th percentile. For example, membership in the set of teachers with high innovative teaching practices, coding membership as fully out of the set if a teacher showed causal values of 0.2 or below and fully in the set if a teacher showed causal values of 0.8 or higher. The cross-over point was set at 0.47, which corresponds to the median value of 15. Table 3 summarizes the descriptive statistics and the threshold value for the each of the variables.

Table 3. Descriptive Statistics and Qualitative anchors

N=194

Variable	Mean	SD	Median	Min.	Max.	Qualitative anchors		
						full membership	cross-ver	full non-membership
ITP	14.96	3.87	15	7	24	0.8	0.47	0.2
TI	11.56	2.67	12	4	16	0.8	0.66	0.2
TGE	40.12	7.90	39	13	52	0.8	0.66	0.2
TME	12.09	3.15	11	5	20	0.8	0.40	0.2
SUM	9.63	2.24	10	3	12	0.8	0.77	0.2

Note. ITP: Innovative teaching practices TGE: Teacher general efficacy, TME: Teacher multicultural efficacy, TI: Teachers′ innovative climates, SUM: Social utility motive to become a teacher

Analysis of Necessary Conditions

For necessary conditions analysis, consistency of more than 0.90 is recommended [17]. As the first step to necessary condition analysis, the positive and negative forms of four

As consistency for conditions ranged from 0.28 to 0.85, none met the threshold (0.90). Therefore, TGE TME, TI, and SUM were not necessary conditions for innovative teaching practices in Korean secondary multiethnic classrooms.

causal conditions were included in the necessary analysis. Based on the existing recommendations, the acceptable level of consistency for the test of necessity was set at 0.90. Table 4 includes analyzing the necessary conditions of TGE, TME, TI, and SUM for innovative teaching practices.

Table 4. Necessary conditions for TGE, TME, TI, SUM for Innovative teaching practices

Variable	High innovative teaching practices		Low innovative teaching practices	
	Consistency	Coverage	Consistency	Coverage
TI	0.83	0.69	0.78	0.47
~TI	0.36	0.70	0.49	0.68
TGE	0.85	0.70	0.75	0.45
~TGE	0.34	0.65	0.50	0.70
TME	0.75	0.76	0.64	0.47
~TME	0.47	0.64	0.67	0.66
SUM	0.85	0.66	0.76	0.43
~ SUM	0.28	0.62	0.41	0.67

Note. ~ indicate logical negation and is interpreted as the absence of factors.

Analysis of sufficient conditions

For analysis of sufficient conditions, truth table analysis was performed, which is an aggregated form of the raw data and has as many rows as possible combinations of values on the causal conditions. The configurations leading to highlyinnovative teaching practices can differ from those leading tolow innovative teaching practices due to the asymmetry causality. Therefore, I carried out fsQCA modeling a low level of innovative teaching practices and high innovative teaching practices separately. Table 5 shows the distribution of cases across combinations of causal conditions for highly innovative teaching practices and a low level of innovative teaching practices.

Table 5. Truth table showing four causal conditions of innovative teaching practices

TI	TGE	TME	SUM	number	High innovative teaching practices		Low innovative teaching practices	
					raw consist.	PRI consist.	raw consist.	PRI consist.
1	1	1	1	52(30%)	**0.81**	**0.69**	0.53	0.24
1	1	0	1	31(48%)	0.78	0.57	0.70	0.40
1	1	1	0	12(55%)	**0.82**	0.62	0.69	0.35
1	0	0	1	11(62%)	0.74	0.37	**0.84**	**0.62**
0	0	0	1	11(68%)	0.74	0.34	**0.84**	**0.61**
0	1	0	1	9(73%)	**0.82**	**0.56**	0.77	0.43
1	0	1	1	8(78%)	**0.84**	**0.64**	0.73	0.36
1	0	0	0	8(83%)	0.66	0.22	**0.89**	**0.75**
0	1	1	1	7(87%)	**0.85**	**0.64**	0.74	0.36
1	1	0	0	6(90%)	0.77	0.39	0.83	0.57
0	1	0	0	5(93%)	0.78	0.37	0.86	0.60
1	0	1	0	4(95%)	0.77	0.46	0.81	0.54
0	0	0	0	3(97%)	0.71	0.21	0.92	0.79
0	1	1	0	2(98%)	0.78	0.35	0.88	0.65
0	0	1	1	1(99%)	0.86	0.54	0.83	0.45
0	0	1	0	1(100%)	0.77	0.32	0.89	0.68

Note. bold font indicates configurations that are sufficient for the outcomes of innovative teaching practice

The number of logically possible configurations is 16(2^4). As shown in table 5, the number of configurations existing in this sample is equal. When the total N (number of cases) is relatively large, case selection is primarily interested in

diversity [63]. In large-N fsQCA studies, stratified sampling was recommended so that sample well represents a population′s diversity of cases. TALIS sampling was a stratified two-stage probability sampling design, and sampling is suitable for large-N fsQCA studies. The Simpson's diversity index (SDI) was applied to measure sample diversity empirically. The range is from 0 to 1, where high scores (close to 1) indicate high diversity, and low scores (close to 0)

$$SDI = 1 - \frac{\sum_{i=1}^{s} n_i(n_i - 1)}{N(N-1)}$$

n: The number of individuals of species i

N: The total number of all individuals counted

indicate low diversity.

The sample's diversity index was 0.85, which means considerable diversity. Therefore, these distributions show not only the observed configurations in empirical reality but also their diversity. When the total N (number of cases) is relatively small, the frequency threshold should be 1 or 2. When the total N is large, a more substantial threshold should be used. It is vital to examine the distribution of cases across conditions to identify the vector space's most populated sectors. Greckhamer and his colleagues recommend that a threshold be chosen to retain at least 80% of the cases [63]. In this study, because the sample size is large, the frequency threshold set at 7, which covered 87%, as shown in the number column. Those with less than 7 cases were eliminated in the analysis.

The next step was to select a consistency threshold to distinguish causal combinations that were subsets of the outcome from those that were not. For sufficiency analysis, a reasonably well-established consistency threshold is 0.80 for raw consistency. In addition to raw consistency, it is also essential to consider PRI (proportional reduction in inconsistency) scores to avoid simultaneous subset relations of configurations in both the outcome presence and its absence. PRI consistency values less than 0.5 indicate significant inconsistency [14]. Based on the benchmark, in this research raw consistency threshold set at 0.8, which is again above the minimum recommended threshold of 0.75 [14]. Considering both raw consistency and PRI consistency, '1' was assigned for configurations with raw consistency of 0.8 or more, and '0' was assigned for configurations with raw consistency less than 0.8.

After the truth table was constructed, a standard analysis was performed, which procedure provides the complex, intermediate, and parsimonious solutions. Although three solution formulas differ in their degree of complexity, they are logically true because they do not contradict the available empirical information in the truth table [15]. Wagemann and Schneider [17] suggest producing at least two solution formulas. One is based on simplifying assumptions on the logical remainders, which will always lead to the most parsimonious solution. Another one without any such simplifying assumption will always lead to a more complex solution. In this research, both intermediate and parsimonious solutions were summarized in table 6.

Table 6. Configurations for innovative teaching practices

	Configuration			Configuration	
	HC1	HC2	HC3	LC1	LC2
Teachers′ innovative climate	●	●			●
Teacher general efficacy	●		⬤		
Teacher multicultural efficacy	⬤	⬤			
Social utility motive to become a teacher.		●	●	●	
Consistency	0.80	0.81	0.82	0.81	0.85
Raw coverage	0.61	0.59	0.30	0.35	0.36
Unique coverage	0.07	0.05	0.08	0.06	0.07
Overall solution consistency		0.79		0.82	
Overall solution coverage		0.74		0.42	

Note. Black circles represent the presence of a condition, and circles with × indicate its absence. Large circles represent core conditions; small ones represent peripheral conditions. Blank spaces represent ″don′t care.″ HCn describes high innovative teaching practices, and LCn represents low innovative teaching practices

Table 6 shows the results of a fsQCA of highly innovative teaching practices (HC1, HC2, HC3) and a fsQCA of the low level of innovative teaching practices (LC1, LC2). Table 6 shows that ITP is a case of asymmetry causality. Prior researchers (Ragin, Lee) suggest that the configuration's consistency should be above 0.8, and the coverage not be less than 0.3 [53]. As shown in Table 4, all HC1, HC2, HC3, LC1, and LC2 satisfied the criteria. Furthermore, table 4 shows the presence of both core and peripheral conditions. Core conditions are elements of parsimonious and intermediate solutions, and peripheral conditions are omitted in the parsimonious solution and thus only occur in the intermediate

solution. Eventually, core conditions indicate a stronger causal relationship with the outcome, and in contrast, peripheral conditions indicate a weaker causal relationship with the outcome.

Table 6 shows that the core conditions for ITP in classrooms are teacher multicultural efficacy and teacher general efficacy. As shown in table 6, the overall solution consistency for HC was 0.79, which means that the overall consistency and the coverage of three conditions (HC1, HC2, HC3) are appropriate. Also, the overall solution coverage is 0.74. The coverage is a concept similar to R^2 in regression analysis. The three sufficient conditions can explain 70% of the empirical evidence, and this can be interpreted the coverage of the three conditions is adequate. Therefore, the overall consistency and coverage of the three conditions are appropriate. HC1 shows that high teacher multicultural efficacy combined with high teacher general efficacy and high teachers' innovative climate, regardless of altruistic motive to become a teacher, is sufficient to highly innovative teaching practices in Korean secondary multiethnic classrooms. Thus,

HC1 indicates that if the teachers′ innovative climate is established and both the teacher general efficacy and the teacher multicultural efficacy are high, it is sufficient for high innovative teaching practices in Korean secondary multiethnic classrooms.

HC2 shows that high teacher multicultural efficacy combined with high teacher general efficacy and high social value motive to become a teacher leads to highly innovative teaching practices in Korean secondary multiethnic classrooms.

Therefore, it is worth noting that in two configurations for the highly innovative teaching practice (HC1, HC2), teacher multicultural efficacy combined with teachers' innovative climate produced innovative teaching practices in multicultural classrooms.

Otherwise, HC3 shows a third important pathway to highly innovative teaching practices. It indicates that high teacher general efficacy combined with the high motive to become a teacher also allows teachers to implement innovative teaching practices, even though teachers′ innovative climate is low. In

other words, HC3 indicates that even if the teachers′ innovative climate is low, the high level of teacher general efficacy combined with a high social utility motive to become a teacher is a pathway for highly innovative instructional practice in multicultural classrooms.

It is worth noting that teacher multicultural efficacy does not matter for this pathway also. Unlikely HC1 and HC2, where the raw coverage is about 0.6, the raw coverage of HC3 is only 0.3. This result does not mean that HC3 is less important than the others, although raw coverage is a criterion to judge that one pathway is more important than another. A path covering only a few can sometimes be more interesting than other pathways covering many cases about which everybody has already had sufficient knowledge. Teachers′

innovative climate has been suggested as a factor for teachers′ teaching performance, but it turns out that there are cases that are contrary to previous studies. This pathway is exciting and meaningful in that educational research aims to help make sense of empirical cases diversity.

In two configurations for high innovative teaching practices (HC2, HC3), the high motive to become a teacher is a factor by which teachers perform a high level of innovative teaching practices, even though it is a peripheral condition. As shown in table 6, unlike HC1 and HC2, HC3 offers a pathway to a high-level of innovative teaching practices that can be possible even at a low level of teachers' innovative climate. Thus, it is unnecessary to have a high level in all causal variables to reach the outcome variables.

As shown in table 6, the overall solution consistency for low-level innovative teaching practices(LC) is 0.82, and the overall solution coverage is 0.42. It indicates that the overall consistency is appropriate, but coverage of the two conditions is moderately appropriate. LC1 and LC2 show that the absence of multicultural efficacy and general efficacy is a core condition that leads to low ITP. Lack of both multicultural efficacy and general efficacy as a core condition is combined with the peripheral conditions of either the high level of innovative teacher climate or the high level of altruistic motive to become a teacher. LC1 and LC2 can be interpreted to indicate that lack of both multicultural efficacy and general efficacy are the critical conditions that result in low ITP.

fsQCA is sensitive to researcher-specified thresholds and benchmarks related to the calibration of raw data, the minimum frequency of cases in each configuration, and the consistency cutoff. Schneider and Wagemann [17] recommend examining whether research findings are robust should stay true to the logic of set-theoretic analysis rather than mimic robustness tests in regression analyses. As a method for robustness examination of research findings, the

cross-over point varied ±10% for all conditions [63]. The lowest acceptable consistency for solutions was set at 0.82. Finally, the minimum frequency threshold was set at eight. Even if there were minor changes, the results remain substantively unchanged.

Conclusion

Suggestions

Although the innovative teaching practices are not a panacea for all classroom situations, they can improve student-centered activities that increase secondary students' class engagement as opposed to listening passively, which then helps both mainstream students and students from multiethnic backgrounds achieve academic success. Therefore, innovative teaching practices can be a better strategy to enable inclusive and quality education for all, one of 17 Global Goals that make up the 2030 Agenda for Sustainable Development.

Research findings revealed different pathways to produce innovative teaching practices in multicultural classrooms using fsQCA. In pathways, the presence of either multicultural efficacy or general efficacy turns out to be the core condition for high innovative instructional practice, but neither condition is sufficient by itself. These core conditions have to be combined with other factors, including innovative teachers' climate and strong social utility motive to become a teacher. This research finding is different from the previous literature to reveal the relation between innovative teaching

practices and teachers' efficacy, in that teachers can implement innovative teaching in Korean multiethnic classrooms when combining with other factors is met.

Teachers' pedagogical competencies are never completed, must be continuously developed through lifelong learning. The present research findings confirmed teachers' need with high efficacy for equitable education in Korean schools to change more diverse demographically. Teachers' participation in professional development and engagement within the professional learning community positively affects in-service teachers' general efficacy and multicultural efficacy. Therefore, to promote innovative teaching practices and enable inclusive and quality education for all, it is urgently required, above all, that teachers make an effort to actively participate in professional development to improve both their general efficacy and their multicultural efficacy. However, to increase teachers' efficacy, it is not enough to require teachers to make efforts individually.

A structural approach must be accompanied along with individual teachers' efforts since the pre-service teacher education programs [64], in-service teachers' professional development [65-68], and school principal leadership [69-72] have an impact on teachers' teaching efficacy as revealing in prior research. Furthermore, innovative teaching happens more in environments where teachers can access vital professional development programs [45, 46].

Prior research has reported that possible selves are malleable and can be influenced by intervention to enhance their content. Changing possible selves through intervention can lead to positive changes in behavior [30]. Therefore a multifaceted approach should be taken to help pre-service teachers or in-service teachers focus on what they hope to become or what they value need to be provided. In this respect, I would like to make the following suggestions to teacher educators, teacher training institutes managers, and school principals. High-quality, innovative teaching can be implemented in Korean secondary multiethnic classrooms, and quality education for all is achieved.

First of all, for a substantial supply of qualified teachers in demographically diverse classrooms, teacher educators are primarily charged with preparing pre-service teachers. Teacher educators should strive for pre-service secondary teachers to experience or be exposed to multiculturalism and multicultural education through a teacher education program. Another strategy to increase an innovative teaching practice can be proposed, which is equipping pre-service teachers with the knowledge and skills to create an innovative learning culture and improve the approaches teachers might use to develop a culture of innovation.

It is reported that participation in teacher training institute programs, school-based in-service teacher training programs, and professional learning communities raise both teachers' general efficacy and multicultural efficacy. Therefore, in-service teacher training institutes must design in-service teachers with adequate plans for increasingly diverse classrooms so that teachers can advance their multicultural efficacy and general efficacy. Besides theoretical training, teachers also need practical training to apply innovative teaching practices to multicultural classroom activities. In the course of teachers' training, there is a need to provide opportunities for hands-on experience in innovative teaching practices and the theory of innovative teaching practices and

that of multicultural education.

In addition to providing teacher training programs by institutes, it should support teachers' participation in professional development at the school level. The school supports include equipment, other materials, and time allocation for teachers to balance their work schedule, making sure that cooperative professional development is part of the teachers' regularized practices. In Korea, the school principal is an important decision-maker concerning the support needed. Principal transformative leadership has proven to be a significant predictor of teachers' efficacy and higher levels of innovative teaching practices [69-72]. Furthermore, the school principal is the initiator of a school's teacher culture, and the principal leadership has a critical effect on the teacher's climate [73].

In schools where the teacher's climate is espousing the values of innovation, it may not be enough for teachers merely to share the need for an innovative culture at their schools. It is also critical for school principals to emphasize innovative teaching practice, to promote innovation as the organizational norm, and provide organizational support for teachers to increase their ability to reflect the innovative teaching practice in their teaching. Thus, as a strategy for increasing the teachers' efficacy and ultimately improving the teachers' innovative teaching practice in the multiethnic classroom, school principals should be committed to enhancing transformative leadership. Furthermore, the capacity for innovation may be more a collective capacity than an individual one. To build a teachers' innovative climate, school principals and teachers will need to reflect on the school climate.

Recommendations for Future study

This research contributes to understanding sufficient conditions of innovative teaching practices in multicultural classrooms, and they also help to suggest educational methods for inclusive and quality education for all. A component of the possible selves theory has hardly been applied to teacher education research in Korea. Therefore, this study can expand the teacher education theory. It has proven that the possible selves theory is a valuable theory for approaching the innovative teaching practices in Korea. Additionally, it is worth noting that this study's results proved that innovative teaching practices are social phenomena that have three characteristics of causal complexity, using fsQCA. The fsQCA can improve the understanding of some phenomena that conventional statistical methods cannot explain well, and innovative instructional practice is a phenomenon. Therefore, it can be concluded that the fsQCA is a powerful tool for better understandings of the complex educational reality, such as innovative teaching practices. However, there is little research using the fsQCA in Korean educational field research. This study will be able to contribute to the expansion of methodology in the educational field also.

Along with this study's significance, this research has some limitations. First of all, there was an inherent limitation in that this research's scope is restricted to the variables measured in TALIS 2018. The results of any fsQCA are dependent on the conditions included in the study. The change of sets of conditions constructs different property spaces and hence potentially different configurations in fsQCA. Principal

leadership, teachers' constructivist beliefs on teaching, and cooperative professional development have been considered necessary for implementing innovative teaching practices. However, the school principal's leadership and cooperative professional development conditions are excluded in this study because of the restrictions of the variables provided in TALIS 2018. The integration of other potential factors would be a more well-conditioned strategy to substantiate all for education in the future. It also helps to establish a robust theoretical foundation to investigate conditions of innovative teaching practices. Therefore, I suggest that research design could be extended to include individual factors (e.g., teachers' constructivist beliefs on teaching) or environmental factors (e.g., principal leadership or cooperative professional development). These variables could potentially affect teachers' innovative teaching practices in multicultural classrooms and comprehensive analysis to produce innovative teaching practices in future research.

Secondly, even if the innovative teaching practice's measurement items are diverse, research findings might not be directly applicable to other types of innovative teaching practices not covered in the dataset, such as teaching through artificial intelligence and teaching through flipping classrooms and teaching through virtual reality. Thus, the innovative teaching practice inventory needs to be added in future research, which will enhance construct validity and broaden our understanding of the innovative teaching practices.

Thirdly, research findings are based on a self-reported questionnaire method and one-off data collection. To understand research findings using the fsQCA and obtain more in-depth insights on the innovative teaching practice in multicultural settings, other data sources, such as data from class observations or data from interviews with the principal or teachers, need to be included in future research.

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