韓國數學敎育學會誌 시리즈 A <數學敎育>
https://doi.org/10.7468/mathedu.2019.58.1.101
2019. 2. 제 58권, 제 1호, 101-120.

J. Korean Soc. Math. Ed. Ser. A:
The Mathematical Education
February. 2019, Vol. 58, No. 1, 101-120.

Exploring Changes in Multi-ethnic Students' Mathematics Achievement Motivation : A Longitudinal Study using Expectancy-Value Theory

Eunhye Cho(Boston College, Ph. D. student)
Sunghwan Hwang(Boston College, Ph. D. candidate)†

Ⅰ. Introduction

Why are some multi-ethnic students willing to study hard and get good scores while others are uninterested in mathematics? Why are some multi-ethnic students likely to investigate new mathematical tasks and pursue them despite challenges, while others easily give up studying mathematics in the face of adversity? These questions might be addressed by Expectancy-Value theory, which was first introduced by Atkinson(1964) and further developed by Eccles et al.(1983). According to the theory, students' different levels of persistence, motivation, and achievement in mathematics might be explained by their perceived ability, expectations for success, and subjective task values(Wigfield & Eccles, 2000). When students believe that they are good at mathematics and likely to receive good scores on tests, they are likely to devote more time and energy to studying mathematics. Students are also willing to enroll in mathematics courses if they view studying mathematics as important for their future careers(Eccles & Wigfield, 2002; Niemiec & Ryan, 2009; Schiefele & Csikszentmihalyi, 1995).

Previous research on expectancy-value theory has provided a sense of the influence of students' perceived personal expectancy and task values on their achievement motivation(Berger & Karabenick, 2011; Greene, DeBacker, Ravindran & Krows, 1999; Köller, Baumert & Schnabel, 2001). However, most of those studies analyzed students' motivation using survey data at one specific time point, and so we still know little about how students' motivations change over time and why such changes may happen. To pursue such questions, narrative research methods are appropriate. As Clandinin(2006) pointed out, narrative inquiry can capture continuity (time), interactions (people), and situations (places) in participants' life experiences because "people shape their daily lives by stories of who they and others are and as they interpret their past in terms of these stories"(Clandinin, Pushor & Orr, 2007, p. 22). Given that students' voices have been neglected or underrepresented in most previous studies about motivation, examining students' experiences in their own words might help researchers more accurately understand the how and why questions mentioned above. Also, allowing students to express their thoughts regarding their expectancies and task values might shed light on important educational issues of the day, which should be resolved to support

* 접수일(2018년 12월 14일), 수정일(2019년 1월 23일), 게재확정일(2019년 2월 12일)
* ZDM분류 : C23
* MSC2000분류 : 97C30
* 주제어 : achievement motivation, expectancy-value theory, multi-ethnic students
† 교신저자

students' learning(Creswell & Creswell, 2017).

The present study examines changes in achievement motivation for mathematics among multi-ethnic students in South Korea. Because many multi-ethnic students struggle with school life because of their lack of achievement motivation(Ju, 2016; Ministry of Gender Equality & Family, 2015), analyzing their motivation over time might shed light on how and why motivations change among multi-ethnic students and what factors influence such processes, producing a baseline that can be extended to research on other groups of students. Therefore, the purpose of this study was to analyze change in multi-ethnic students' achievement motivation in mathematics using the expectancy-value model(Eccles et al., 1983) with narrative inquiry methods.

Ⅱ. Theoretical framework

1. Expectancy-value theory

The early expectancy-value theories investigated factors influencing students' achievement related behaviors (e.g., perseverance and desire for success) in laboratory-based environments(Wigfield, Tonks & Klauda, 2009). Atkinson(1957, 1964), for example, proposed a conceptual expectancy-value model, arguing that individual achievement behaviors are outcomes of motive, expectancy, and incentive value. In comparison, modern expectancy-value studies conducted in real-life contexts have examined both students' psychological aspects and their social-cultural determinants(Wigfield et al., 2009). Also, they assume a positive relationship between expectancies and values(Eccles & Wigfield, 2002), which was inversely described by Atkinson.

For example, Eccles et al.(1983) proposed an expectancy-value model for students' performance and choice. In this model, cultural milieu and socializers' (e.g., teachers and parents) beliefs and behaviors affect students' interpretations of their experiences (attribution), their perceived abilities, and their goals. These factors, in turn, influence their expectations for success and their task values, which lead to the development of achievement-related choices and performances. That is, by synthesizing previous studies about motivation, they viewed students as not only decision makers but also creators of meaning in that their achievement motivation is determined by their personal aptitude, perceptions, experiences, and social-cultural factors.

Eccles and Wigfield(2002) defined expectancies for success as "individuals' beliefs about how well they will do on upcoming tasks, either in the immediate or longer-term future"(p. 129), which is similar to Bandura's(1977) personal efficacy beliefs. Also, Eccles and her colleagues categorized subjective task values into four components: attainment value, intrinsic value, utility value, and relative cost(Eccles et al., 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Attainment values are related to students' self-schemas. More specifically, because students' choices and performances might demonstrate aspects of their identity, such as masculinity or competence, they might develop a certain behavior and motivation. Intrinsic and utility values are analogous to intrinsic and extrinsic motivations as suggested by Deci and Ryan(1985) in that the two values relate to enjoyment from pursuing the subject and future goals, respectively. Last, cost is connected with negative consequences of engaging in the subject, such as performance anxiety related to the subject or loss of time to study other subjects. Wigfield and Eccles(2000) also claimed that students' achievement motivation could be explained by their ability beliefs, expectancies for success, and task values because students were likely to develop a positive motivation when they assumed that they were good at a subject and the subject was valuable.

2. Change and development of motivation

Research suggests that students' expectancies and task values are important because they may influence students' achievement motivation and achievement (Eccles et al., 1983; Greene et al., 1999; Köller et al., 2001; Metallidou & Vlachou, 2007; Schiefele & Csikszentmihalyi, 1995). In terms of expectancies, Eccles et al.(1983) originally differentiated expectancies for success from ability beliefs because expectancies for success are related to students' beliefs about their performance on prospective tasks, while ability beliefs are concerned about students' perception of their current competence at a specific task(Wigfield & Eccles, 2000). Because research has increasingly found highly positive relationships between these and that students cannot recognize them as two different components(Eccles & Wigfield, 2002), however, the term expectancy could be used to represent both expectancies for success and ability beliefs.

Given that students' expectancy beliefs apply to both students' current abilities and future successes, and that their abilities, in turn, are related to their motivation(Harter, 2006), it is reasonable to assume that students' motivation is likely to change over time due to the influence of test scores and competitions with their peers, which measure and revise their mathematical abilities. High mathematics achievement may promote positive academic motivation because students are likely to devote more time and energy when they feel confident in that area(Harter, Whitesell & Kowalski, 1992) and develop motivation that further influences their future achievements(Singh, Granville & Dika, 2002). Therefore, students' mathematics motivation is likely to be stable over time unless their achievements and expectancies change. On the other hand, students' mathematics motivation is inclined to decrease when they fail on a test and perceive their lack of mathematical abilities.

Research also suggests that students' motivation may be influenced to change by four factors of task values. First, achievement motivation may be influenced by their attainment value; students who want to develop a certain type of identity may come to feel that they have to study mathematics more. For example, African-American students in Stinson's(2013) study were eager to get high mathematics scores and solve advanced mathematics problems to dispel negative labels imposed them as African-Americans studying in a White-dominant subject. Motivation also is influenced by intrinsic values such as enjoyment and interest gained from the process of solving mathematics problems. Kloosterman(2002) has found that how students think about mathematics may influence their interest in mathematics, and their interest, in turn, affects their motivation for learning mathematics. Third, utility value may influence students' motivation. When students view mathematics as a valuable subject for their future, they are likely to take up mathematics related subjects and study them(Black et al., 2010). Finally, cost may influence motivation. Specifically, researchers have found that students' perceived abilities in a certain subject in comparison to other subjects influence their future careers(Bandura, Barbaranelli, Caprara & Pastorelli, 2001; Trautwein et al., 2012). For example, when students believe that their mathematics abilities are better than their verbal abilities, they are likely to pursue mathematics-related careers(Wang, Eccles & Kenny, 2013).

As explained by expectancy-value theory(Eccles et al., 1983), students' motivations change and develop through both their perceived expectancy and their task values. From a conceptual point of view, therefore, students' expectancy beliefs are positively associated with their task values(Trautwein et al., 2012). For example, students who attribute intrinsic

and utility values to mathematics are likely to study hard, resulting in improved mathematical achievement and abilities. Consequently, their enhanced mathematical abilities positively influence their expectancy beliefs. In some cases, however, students could have high value beliefs and low expectancy beliefs or vice versa. More specifically, students' certain social-cultural backgrounds, such as immigration status, home language, and Social-Economy-Status (SES), may negatively influence their expectancy beliefs(Akiba, LeTendre & Scribner, 2007) although they have high task values beliefs. For example, marginalized students might be frustrated by their mathematics test scores and develop low expectancy beliefs(Dweck, 2002), although they realize the importance of mathematics in school success and future careers.

However, such misalignment between expectancy beliefs and task values is not likely to be sustained. Over time, across all domains and grade levels, students' subject-specific expectancy beliefs become aligned with their task values(Wigfield et al., 1997) because as students become convinced of their lack of mathematics ability, they may lose intrinsic value and spend more time studying other subjects (cost) to develop a positive identity (attainment value) and get good test scores (utility value). However, it is important to note that as Bandura(1977) and Eccles and Wigfield(2002) pointed out, students measure their abilities and develop value beliefs based not only on their personal master experiences but also on vicarious experiences and verbal persuasion.

3. The current study

This study differed from previous studies of students' motivation in two ways. First, interviews were conducted with multi-ethnic students, who have not been widely used as participants. Second, this study followed the same students over three years, from the sixth through eighth grade, while prior studies usually focused on student motivation at a certain point in time. Thus, this research sheds light on how and why multi-ethnic students' mathematics motivations develop and change over time. The main goal of this study was to apply an expectancy-value model to explain changes in multi-ethnic students' achievement motivation in mathematics during sixth (2012) to eighth (2014) grades in the transition from elementary to secondary school. The following research questions guided this study:

(1) What were the levels of individual student's achievement motivation in mathematics in 2012 and in 2014?

(2) Overall, how did students' motivation change over time?

(3) What factors influenced changes in motivation?

Ⅲ. Methods

This study is part of a larger longitudinal study investigating the struggles and successes of multi-ethnic students in Korean schools. In the larger study, we observed multi-ethnic students' classroom participation across several subjects and conducted interviews with them. It is important to note that most participants were attending a multicultural alternative school established to support the learning of multi-ethnic students during elementary and middle grades, so the difficulties they faced may not be aligned with those of multi-ethnic students attending ordinary schools. However, in the alternative school these students, like all students, were continually socializing with peers and teachers, comparing their achievements with those of others, and thinking about their future lives.

1. Data sources

Participants in this study included six multi-ethnic

students (see Table 1), each with at least one parent who had immigrated from a foreign country. Four of the students were Asian and had immigrated to South Korea in either 2011 or 2012, so their Korean language abilities were very emergent. The ethnicities of the other two students were African-Asian and Caucasian-Asian, both of whom were born in Korea and so were fluent in speaking Korean. These students were interviewed throughout the 2012 and 2014 school years. In 2012, all six students were sixth graders and studying in the same classroom at Dasom elementary school, which comprised more than 90% multi-ethnic students. Throughout the first target year (2012), the first researcher served as an assistant teacher in the classroom, visiting the school at least two times a week and supporting classroom teachers' instruction. Her regular presence helped her create a close bond with the participants, allowing her to conduct informal interviews with the students more than once a week and formal interviews total 12 times a year.

After graduating from elementary school, while all began by attending ordinary Korean middle schools, four of them transferred to the alternative middle school after a few months because of difficulties adapting to the regular school environment. Only two students (Sunmi and Kihong) remained in a regular middle school. In 2014, the researcher did not attend their classrooms. However, she kept in touch with them through Social Networking Service and conducted formal interviews eight times a year (see table 3). All formal interviews were audio-recorded.

All interviews, while guided by a critical perspective in which both interview and interviewee contribute to the topic and direction of the co-constructed narrative, we began with a semi-structured protocol focused on students' achievement motivation that enabled us to obtain rich data on our target topic. Because some of our participants had emergent Korean language abilities, we assumed that providing a semi-structured interview rather than conversational style questioning might help them express their ideas and thoughts more accurately. Another reason for our approach was that we desired to systematically examine individual students' different levels of motivation to identify factors that might influence changes in their motivation.

[Table 1] Demographics of participants

	Jaemin	John	Sunmi	Joonseo	Kihong	Suji
Birth year	2000	2000	1999	1999	1999	1999
Gender	Male	Male	Female	Male	Male	Female
Ethnicity	African-Asian	Caucasian-Asian	Asian	Asian	Asian	Asian
Home Country	Korea	Korea	China	China	China	Philippine
Immigration Year	NA [a]	NA	2011	2011	2012	2012
Korean ability	High	High	Low	Low	Low	Low
Elementary school	Dasom [b]	Dasom	Dasom	Dasom	Dasom	Dasom
Middle school (8th)	Dasom	Dasom	Jeil [c]	Dasom	Miso [c]	Dasom

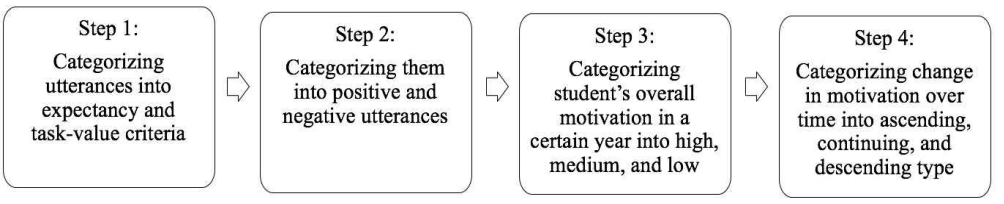
Note. [a] These students were born in South Korea, [b] Multicultural alternative school. [c] Ordinary Korean school

[Table 2] Sample questions for analyzing students' achievement motivation

Questions for Expectancies	Questions for Task Values
1. Are you good in mathematics? How about your achievement? Can you let me know your test scores? (perceived ability) 2. In which subjects are your scores the best? Is mathematics achievement among your best subjects? (perceived ability) 3. What do you think about your mathematics achievement in the preceding year? Do you expect any improvement now compared to then? (expectations for success)	1. Do you believe that studying mathematics is important for you? Why? (Attainment values) 2. Do you like studying mathematics? Have you ever studied mathematics because of your intrinsic curiosity? (intrinsic value) 3. Do you believe that studying mathematics is important for your future? Why? (utility value) 4. Do you have any performance anxiety and concerns with regard to studying mathematics? Have you ever felt that you sacrificed time studying other subjects because of mathematics? (relative cost)

[Table3] Information about data collection in 2012 and 2014

Type/Location	Questions Topics	Characteristics &Frequency
Formal/ School counseling room	- Expectancies and task values related to mathematics learning (see Table 2) - Beliefs about and behaviors related to mathematics learning	In 2012, six students interviewed individually (April and October): total 12 interviews In 2014, a group interview with three students and individual interviews with the other three students in each of two semesters (April and October): total eight interviews
Informal/ classroom, hallway & Cafe	- General school and social lives - Beliefs about and behaviors related to other school subjects - Socializers' beliefs and behaviors	Each semester, more than one unstructured conversational interviews in a week.



[Fig. 1] Data analysis process

[Table 4] Definitions and Examples items in the Code Book

Type (Step 1)	Level (Step 2)	Definition & Example	Code
Perceived ability	Positive	Perceiving mathematics achievement as high or as higher than achievement in other subjects *For me, sixth grade mathematics textbook is too easy (Sunmi, 2012)*	E[a]PP12[c]
	Negative	Perceiving mathematics achievement as low or as lower than achievement in other subjects *The thing (math) that I cannot catch up with. (John, 2012)*	EPN12
Expectation for Success	Positive	Having high expectations of good mathematics achievement *I have never failed to succeed in math class. (Sunmi, 2014)*	EEP14
	Negative	Having low expectations of good mathematics achievement *Epic fail in math. (John, 2014)*	EEN14
Attainment value	Positive	Constructing positive self-identity through learning mathematics *I want to be viewed as a smart student (Kihong, 2012)*	T[b]AP12
	Negative	Constructing negative self-identity through learning mathematics *I felt ashamed (in the middle school math class). (Suji, 2014)*	TAN14
Intrinsic value	Positive	Enjoying the process of learning mathematics as it is *Doing math is quite joyful. (Joonseo, 2012)*	TIP12
	Negative	Disliking the process of learning mathematics as it is *(Doing math is) not interesting. (John, 2014)*	TIN14
Utility value	Positive	Believing that being good at mathematics can enable one to earn valuable external rewards *In order to succeed in Korean society, I should get a good grade in math. (Suji, 2012)*	TUP12
	Negative	Believing that being good at mathematics does not highly correlate with earning valuable external rewards *If I keep doing this (math), I might fail in the future. (John, 2014)*	TUN14
Relative cost	Positive	Believing that learning mathematics is more valuable than doing learning other subjects *I solely focused on math and science. (Sunmi, 2014)*	TRP14
	Negative	Believing that focusing on another subject is more valuable than learning math *I switched to invest my time into learning Chinese. (Kihong, 2014)*	TPN14

Note. [a] Expectancy beliefs, [b] Task values, [c] Year when data collected

We developed an interview protocol based on Eccles and her colleague's(Eccles et al., 1983; Eccles & Wigfield, 1995; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) studies implementing the expectancy-value theory. In these interviews, students were asked to narrate their perceived mathematical abilities, future expectations, and beliefs about four task values. They were specifically asked about their mathematics scores and mathematics achievement compared to other subjects, anticipated mathematics

achievement in the future, most valuable subjects for their future, their perceptions of doing mathematics and of its usefulness (see Table 2). During the interview, we found that while this protocol limited students' responses to mathematics related experiences and thoughts, it provided them with some space to think about their own life stories and worked as a scaffolding for them to communicate how certain events were related to their expectancies and task values, which could not have been elicited without using the protocol. It is important to note that although we used the interview protocol to understand students' motivation related beliefs and events, we also implemented unstructured conversational interviews to elicit narratives about students' general school and social lives, as well as their socializers' beliefs and behaviors (e.g., interaction with family) which might wittingly and unwittingly affect their motivations (see Table 3).

2. Data analysis

Based on the narrative interview data, preliminary criteria for determining the six students' levels of motivation were developed. During the preliminary analysis, we found that some students had different levels of motivation across expectancy beliefs and task values. For data analysis, therefore, we developed a codebook featuring two major classifications, type and level, applied as two stages in the coding process. First, under type, we coded utterances expressing expectancy beliefs (Perceived ability and Expectation for success) and task values (Attainment value, Intrinsic value, Utility value, and Relative cost), and then, under level, we coded the utterances as positive or negative, utterances, resulting in 12 categories of motivation-related codes (see Figure1 and Table 4).

Once we had identified all types of motivation-related codes, we coded two students' transcription data (one-third of the data) independently and met to resolve any differences through consensus. We then recoded the transcription data and calculated Kappa's coefficient, obtaining an inter-rater agreement of 0.81 with a range of .65-.97(Carey, Morgan & Oxtoby, 1996). Next, we each separately coded the data of two of the remaining four students. When either encountered an unclear utterance, we conferred to determine an optimal code together. During this process, we kept in mind Clandinin's(2006) advice to consider time, people, and place with regard to interviewees' life experiences when analyzing narrative data.

Each individual student's transcript was coded to provide evidence for classifying his/her levels of motivation in a specific year as high, medium, or low motivation in order to represent it as a summative attribute (step 3). For example, a student's achievement motivation was classified as high if his/her expectancy beliefs and task values were both positive or low if they were both negative. A student's motivation was classified as medium if he/she had high expectancy beliefs and low task values, or vice versa. Only one student, Suji, who had medium expectancy beliefs and high task values, was classified as having medium level motivation because her task values were not as high as those of other students. As the last step, we compared the students' levels of motivation in2012 and in 2014 to identify any changes. The three patterns of motivation change hypothesized were ascending, continuing, and descending.

Ⅳ. Results and discussion

The results section is organized following two research questions. First, we present individual students' levels of achievement motivation in 2012 and in 2014. Second, we discuss how and why their

levels of motivation had changed in the second assessment.

1. Phase one (2012)

In 2012, three of the six students had high, and two had medium, and one had low overall achievement motivation (see Table 5).

High motivation. Sunmi, Joonseo, and Kihong were identified as having high achievement motivation. Sunmi liked to study mathematics (intrinsic value) and felt confident in mathematics (expectancy). She described mathematics as "the most manageable subject," in which she could accomplish the most among all subjects. Because she believed in her mathematical abilities and enjoyed studying the subject, she personally wanted to study mathematics more beyond the school curriculum. Sunmi's achievement motivation was also closely related to attainment and utility values. She described studying mathematics as "rewarding" and believed that doing mathematics would strengthen her competitiveness and develop a positive identity while helping to dispel negative stereotypes of multi-ethnic students as not able to do well academically. Sunmi also mentioned that studying mathematics might help her to become a doctor. This high motivation for learning mathematics was, in part, influenced by her mother and teachers, who, she said, encouraged her to study more because they considered mathematics is one of the most important subjects for multi-ethnic students to succeed in school.

Similar to Sunmi, Joonseo had confidence in doing mathematics. His high expectancies were related to his past mathematics learning experiences in China, where he had enjoyed studying mathematics and was a high achiever. Thus, although the language in the Korean mathematics textbook was different from that of China, he maintained his interest in studying mathematics (intrinsic value) and focused on similarities of numbers, equations, and graphs in Chinese and Korean textbooks, saying "Doing mathematics is quite joyful. It is numbers, not language. This is what I can do well." Because he recognized his competence in mathematics, he was eager to study mathematics more. In some aspect, his high motivation was reinforced by the similarities between Chinese and Korean mathematics curricula. He did not experience a disconnect between them, so he could learn the mathematics concepts in the sixth grade textbook without wasting time learning the prerequisite fifth grade mathematics concepts. With regard to task values, his perception was similar to Sunmi's. Joonseo believed that he should be good at mathematics to prove his success in a Korean school (utility value) and to be viewed as a smart student (attainment value).

Kihong's expectancy for success was similar to that of Sunmi and Joonseo. In terms of task-values, however, he emphasized relative cost. Because he did not know any Korean when he came to Korea in 2012, he had difficulty understanding the Korean textbooks. Thus, he viewed mathematics as the only subject in which he could get a high score assuming that he could solve mathematics problems by understanding the numbers and equations in the text. Like Joonseo, Kihong viewed the Korean mathematics curriculum as similar to that of China, and so he could easily follow the curriculum despite the language barrier.

Medium motivation. Jaemin and Suji were identified as having medium motivation. Jaemin liked mathematics for its own sake (intrinsic value). He said, "I just like getting to know the new mathematical concept and feeling happy about that." According to him, he actively engaged in the mathematics classroom by asking the teacher questions and interacting with other students. In addition, he recognized the importance of mathematics

achievement for his future (utility value). Despite the high intrinsic value, he placed on mathematics, however, he had low expectancy beliefs. Although his mathematics achievement was above average, he perceived his performance and achievement as insufficient for him to claim that he was good at mathematics. These low expectancy beliefs related to his high achievement in other subjects. Because his mathematics achievement was lower than that in other subjects, he was not sure whether he should invest in studying mathematics more or pursue other subjects which could guarantee high test scores, such as social studies.

Suji placed high task values on mathematics. In particular, she regarded mathematics as a gatekeeper subject (utility value), saying, "in order to succeed in Korean society, I should get a good grade in mathematics." Because of her passion for high achievement, Suji personally studied mathematics at home and wished to solve more advanced problems. Because of the difference between math curricula in Korea and the Philippines, however, her expectancy beliefs and mathematics achievement were low. She stated that the level of mathematics she studied in the Philippines before she came to Korea was "lower" than the Korean mathematics curriculum. As a result, as a sixth grader, she had not learned prerequisite mathematics concepts that the Korean students had learned in fourth and fifth grades.

Low motivation. John, the only student who had low motivation in all categories, viewed mathematics as "the thing that I cannot catch up with." His negative perception of his ability was related to the curriculum gap between the Korean and US curricula. Before transferring to Dasom school, he had attended an international elementary school in Korea in which US curriculum implemented. According to him, the US mathematics curriculum introduced many mathematics concepts in the sixth grade that were included in the Korean 5th textbook, so John had missed many basic concepts in the Korean sixth grade mathematics curriculum. The discrepancy between the US and Korean mathematics curricula made John felt far behind the other students and that he lacked mathematics ability. In terms of task values, John described that the activity of doing mathematics as "not interesting." He preferred to study history and social sciences because these subjects were concerned with current and past stories. Also, he did not think that mathematics might influence his future life (utility value). He said he wanted to be an actor and learn skills related to performance in movies rather than sitting down in the classroom and doing mathematics (relative cost), which he did not like (intrinsic value). As a Caucasian-Asian, his exotic appearance attracted attention from people, so he believed that he could gain popularity among his peers through acting, but could gain nothing through mathematics (attainment value).

2. Phase two (2014)

Only one student had high motivation in 2014. Two of the others had medium and three had low levels of motivation (see Table 5).

High motivation. Among the six students, only Sunmi still had high motivation. She consistently achieved good scores in mathematics, making her confident in the subject, so she liked studying mathematics. These factors, in turn, reinforced her achievement motivation. The high intrinsic value she placed on mathematics was in part related to her mathematics teacher, who was very supportive, and to her family. Sunmi could easily access the teacher, and the teacher assisted her mathematics learning inside and outside of the classroom. Sunmi said, "our [mathematics] teacher is really kind. She always welcomes my questions and encourages me to study

mathematics." Also, her mother continuously emphasized the importance of mathematics achievement for college entrance and as a gatekeeper to success in Korean society. She asked Sunmi to put more effort into high mathematics achievement. When Sunmi failed on the test, her mother blamed her and compared her achievement with that of other high-achievers. In addition to the mother's admonitions, she felt a responsibility to be a role model for her younger siblings, who would be attending elementary school during the next few years, by showing high mathematics achievement (attainment value). She believed that if she received good mathematics scores, her siblings might develop positive self-efficacy in school subject regardless of their home backgrounds.

Medium motivation. Joonseo and Kihong had medium levels of expectancy and task-values. Their current levels of mathematics achievements were fairly good, and they had some interest in studying mathematics, but both were concerned about their future mathematics achievement. Because middle school mathematics became more challenging over time, they were more intimidated by new mathematics concepts. In addition, they realized that they needed strong Korean language abilities in order to understand mathematics problems more accurately. That is, their lack of Korean language skills combined with advanced mathematical concepts had lowered their expectancy beliefs. With regard to utility value and relative cost, they found that other subjects were more aligned with and helpful for their future. For example, Kihong changed his perception of the cost of engaging in mathematics by thinking that studying Chinese language would be more profitable for him. This perception was influenced by his mother and classroom teacher, who advised him to focus on studying Chinese proficiency as a more helpful for entrance to colleges with admission policies prioritizing students with fluent Chinese language abilities.

Influenced by this advice, Kihong replaced studying mathematics with improving his native language as his priority for investing his time and effort. Joonseo also started to believe that studying history and science would be more useful for his future, because, while his mathematics achievement was not low, his history and science achievements were higher. Also, he had less interest in studying any subject than in elementary school. As he became more aware of his low SES background, he wanted to begin making money as soon as possible to raise his standard of living, which made him think that learning mathematics was a waste of time.

Low motivation. Jaemin, John, and Suji had low expectancy and task-values beliefs. They all agreed that they were not likely to get high mathematics scores and had little motivation to study mathematics. They had several characteristics in common. First, they considered other subjects more closely connected to their future careers. Jaemin and John wanted to study acting in order to become performers, and Suji wanted to learn French to be a Korean-French translator. In terms of utility value, John said, "If I keep doing this (studying mathematics), I might fail in the future. I need to study acting instead of mathematics." Second, they experienced failure in a regular middle school. All three students felt a huge achievement gap in mathematics between Korean students and themselves, which made them feel "stupid" (negative intrinsic value). In addition, the classroom atmosphere in a regular school, emphasizing competition, overwhelmed them. Because they did not want to be failures (negative attainment value), they gave up participating in competitive environments. Third, their parents were not concerned about their children's mathematics achievement, and those of two had plans to leave Korea. Thus, learning mathematics

with Korean classmates was not important for them with regard to their future lives (negative utility values). For example, Suji said that as she had only a little time left here, she just wanted to get along with her friends and do the things she really liked, such as dancing and writing poems, instead of studying mathematics.

3. How students' motivation changed

One of the main findings that can be drawn from our data was that, generally, students' motivation declined over time (see Table 6). Originally, we hypothesized three types of motivation change: Ascending, Continuing, and Descending. However, we could find only the last two types. In grade six, three students believed that they had high mathematical competency and their achievements were likely to increase in the near future. In grade eight, however, only one student had high expectancy related beliefs. The other five students did not believe that their achievement could increase. Similarly, while five students had high task value in the elementary school, their beliefs had changed to medium or low levels during the transition in middle school. Although we classified John as a continuing case according to our analytical framework, his case also could be identified as descending motivation in that he lost all motivation for studying mathematics in middle school. These findings concurred with Wigfield et al.'s(1997) findings that older children tended to evaluate their mathematics ability realistically, when their test scores are low, and have low task values, while younger children were likely to be optimistic and have high task values in mathematics.

Another finding was that over time each student's expectancy beliefs and task values reached the same level. In elementary school, for example, Suji had high task values and medium expectancy beliefs and Jaemin had high task values and low expectancy beliefs. In middle school, however, their perceptions of expectancy beliefs and task values were both at a low level. This change might be explained in two ways. On the one hand, in the eighth grade, low level expectancy beliefs might have led students to believe that studying mathematics was useless (the influence of expectancy beliefs on task values). On the other hand, low level task values might have led to less studying mathematics and, in turn, to lower expectations of mathematics achievement (the influence of task values on expectancy beliefs). Whatever the reasons, students' expectancy beliefs and task values seemed interconnected over time (see figure 2).

4. Why students' motivation changed

In this section, we discuss six factors that influence multi-ethnic students' motivation: (a) socializers' beliefs and behaviors, (b) peers' achievements, (c) past learning experiences and the gap between previous and current mathematics curricula, (d) achievement in other subjects, (e) home backgrounds, and (f) perceived task values (see Figure 2).

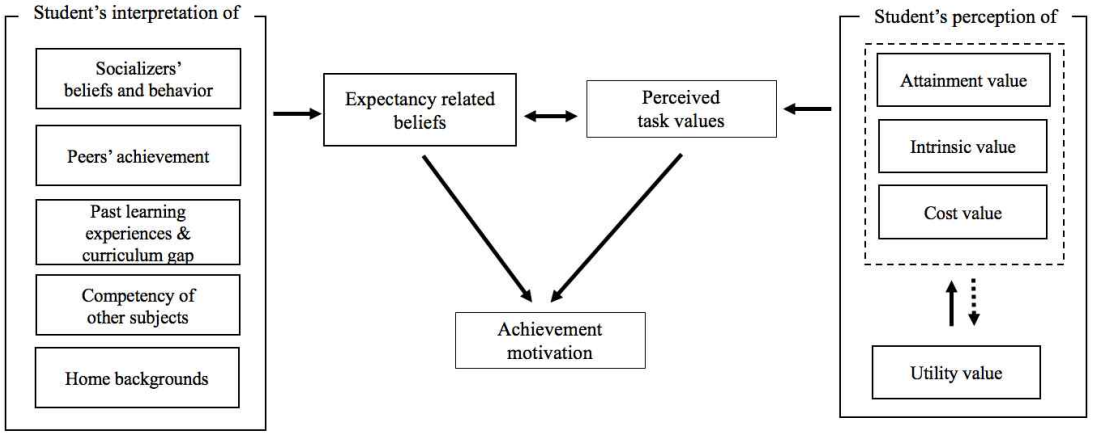
First, the roles played by socializers, including their beliefs and behaviors over time, were among the important factors in the development of students' achievement motivation. When parents prioritized mathematics achievement, as in Sunmi's case, students were more likely to be eager to engage in studying mathematics. However, when parents were not concerned about mathematics achievement, students were inclined to devalue mathematics learning. Furthermore, mathematics teachers' attention to and support for students were related to students' motivation. As illustrated by Sunmi's case, when students believed that their teachers supported their mathematics learning, they were likely to sustain mathematics motivation.

[Table 5] Students motivation in 2012 and 2014

Name	In 2012			In 2014		
	Expectancy	Task values	Overall motivation	Expectancy	Task values	Overall motivation
Sunmi	High	High	High	High	High	High
Joonseo	High	High	High	Medium	Medium	Medium
Kihong	High	High	High	Medium	Medium	Medium
Jaemin	Low	High	Medium	Low	Low	Low
Suji	Medium	High	Medium	Low	Low	Low
John	Low	Low	Low	Low	Low	Low

[Table 6] Comparing student motivation over time

Name	In 2012		In 2014		Change Type
	Expectancy	Task values	Expectancy	Task values	
Sunmi	High	High	High	High	Continuing
Joonseo	High	High	Medium	Medium	Descending
Kihong	High	High	Medium	Medium	Descending
Jaemin	Low	High	Low	Low	Descending
Suji	Medium	High	Low	Low	Descending
John	Low	Low	Low	Low	Continuing/ Descending



[Fig. 2] The developmental process of our participants' achievement motivation
Note. Solid and dash lines indicate strong and weak relationships, respectively.

It is important to acknowledge, however, that the influence of teachers' and parents' attitudes toward mathematics was mediated by students' interpretations. For example, Suji and John interpreted their parents' plans to immigrate to other countries as a signal for ceasing to study mathematics, although their parents had never encouraged that. In addition, some mathematics teachers might support multi-ethnic students' learning, while students' might not have been aware of the assistance they received from them. Because we analyzed only students' interview data, we could not compare students' interpretations of teachers' and parents' mathematics-related beliefs and behaviors with those of the teachers and parents themselves. Despite these limitations, our data showed the importance of explicit socialized guidance with regard to mathematics learning, as well as students' interpretation of such guidance.

Although the contributions of peers on motivation development was not emphasized in Eccles and Wigfield's(2002) study, most multi-ethnic students measured their mathematics competency by comparing their performance with that of their peers, and they were constantly evaluating the difficulty of mathematics content whether they had enough ability to persist in doing mathematics based on peers' mathematics achievement. When they felt that the mathematics content was manageable and they were competent in mathematics in relation to their peers, their expectations for future mathematics achievement were likely to positive. On the other hand, if they compared themselves with their peers unfavorably, they easily believed that they were not "math persons" and were likely to be skeptical about their future mathematics achievement. This is because, students were likely to value subjects in which high achievement seemed guaranteed(Harter, 2006; Harter et al., 1992). In the middle school, for example, in which classes had more than 25 students, including Korean students, they more realistically assessed their mathematical ability in comparison with others and downgraded their competency in mathematics. As a result, some students virtually gave up studying mathematics.

Another important factor which influenced students' motivation was past learning experiences and the gap between mathematics curricula in the students' previous and current schools. Mathematics curriculum determined what concepts students were supposed to have learned in the past and should learn in their current grade. Chinese immigrant students viewed the Korean and Chinese mathematics curricula as quite similar, though the textbooks were in different languages. On the other hand, Suji and John viewed the level and expectations of the Korean mathematics curriculum as much higher than those of their previous school curriculum. Therefore, these students had to first learn fourth and fifth grade mathematics concepts to be ready for sixth grade concepts. When they entered the eighth grade without properly understanding elementary level mathematics concepts, their mathematics deficits became more evident, solidifying their low mathematics motivation.

The fourth factor, which Eccles and Wigfield(2002) also did not discuss, was the students' achievement in other subjects. We found a negative relationship between students' mathematics motivation and competencies of other subjects, in part. It was clear that students wanted to focus on subjects related to their abilities, which might also assure their success. Thus, positive experiences in other subjects devalue studying mathematics and decreased students' mathematics learning motivation. They perceived that their higher achievement in other subjects increased the cost of studying mathematics, a subject in which they could not succeed no matter how hard they tried, so they rationalized giving up on it and investing their time and effort elsewhere.

The fifth factor was students' home backgrounds. As illustrated in Joonseo's case, when he felt that his parents could not support his education because of lack of money, he wanted to get a job and start earning money as early as possible. In addition, an unstable home environment, as was the case with Suji, negatively influenced students' achievement motivation. Because she was uncertain about what might happen in the future, she focused on enjoying the present by spending time with friends and doing activities that made her feel happy. That is, when students perceived no future benefit from studying mathematics, they saw no point in it.

With regard to task values, we found that utility value aligned with perceived competency had a driving force to change other values. Previous research about motivation has shown that intrinsic value is superior to utility value, meaning that intrinsic is more powerful than extrinsic motivation(Middleton & Spanias, 1999). However, intrinsic motivation proved insufficient to sustain most of the focal students' motivation. Instead, they estimated the value of studying mathematics based on their perceptions of its utility, which was related to their expectancy might have the power to overcome their low intrinsic motivation. Here we were not claiming that multi-ethnic students' task values were influenced only by utility value. Rather, we argue that presumably utility value might be more influential than other task values.

Specifically, when students believed that they were doing well in mathematics and studying mathematics could enhance their future prospects, they tended to perceive that studying mathematics would help them establish a positive identity (attainment value), which, in turn, could lead to the development of interest in mathematics itself (intrinsic value). However, when students viewed themselves as failures in mathematics and believed that mathematics was not relevant to their future careers, they assumed an alternative cost perspective and pursued other subjects. For example, when Kihong perceived that studying Chinese language would help him get into college, his achievement motivation in mathematics declined. Also, Jaemin and John both believed that their competencies in dancing and acting might provide a successful future, so learning mathematics was not important in their lives.

Ⅴ. Conclusion and implication

This study examined the trajectories of six multi-ethnic students' changes in motivation for mathematics learning between the sixth and eighth grades and how and why these changes occurred during this transitional period. Employing a three-year longitudinal case study, we found that students' achievement motivation in mathematics generally decreased. In this process, expectancies of success in mathematics and task values of studying mathematics served as strong indexes to understand their ways of engaging in mathematics. The patterns in the ways multi-ethnic students developed motivation have implications for supporting their mathematics learning and for sustaining their motivation to study mathematics in the context of the transition occurring in grades six through eight. We argue that in order to increase and sustain multi-ethnic students' achievement motivation, educators and parents should recognize that motivation is contextually formulated in the intersection of current people, time, and space, not a personal entity formed in an individual's mind.

In the face of the challenges a multi-ethnic student may experience with using a new language and navigating a new environment, socializers need sufficient time to clarify their concerns about and support for the development of students' mathematics motivation and achievement by enabling them to

comprehend the value of studying mathematics and to recognize their competency in the subject. Otherwise, young students might believe that their mathematics learning is of no importance to anyone, including themselves. In addition, supportive mathematics curriculum and resources should be provided so as to support multi-ethnic students' mathematics learning, perhaps similar to the sheltered language arts and language classes in the US for students at the beginning level of English (Hansen-Thomas, 2008), Korean schools might support multi-ethnic students' mathematics learning by providing alternative curriculum and instruction aligned with their mathematics level. To be clear, we do not argue that multi-ethnic students should learn mathematics separately from other Korean students. Instead, we suggest implementing extra curriculum activities outside of regular mathematics classroom to make them learn basic mathematics concepts required to learn current level mathematics. The sheltered mathematics classroom might help them connect prerequisite and current year mathematics concepts. At the same time, Korean schools should develop a non-competitive learning environment which harmonizes the learning of students at different levels of achievement.

Dispelling multi-ethnic students' myths regarding negative relationships between studying mathematics and achievement in other subjects might be also critical for sustaining mathematics motivation. Teachers and parents should explain that studying mathematics does not jeopardize their achievement in other subjects. Rather, it might provide them with another tool for success in Korean society. Last, parents should endeavor to sustain positive educational home environments. Given that individual home environments vary, it is hard to specify exactly how an educational environment might be created, but at the very least, parents should make sure the home environment does not provide a reason for their children to interrupt their studying. They should understand that when some students become aware of challenges in their home, they are likely to want to give up studying and address family issues, an outcome the parents should make every effort to avoid.

As a narrative study analyzing multi-ethnic students, this study has some limitations. As a qualitative study with a small number of participants, it does not permit generalization of the findings to other students. Also, we could not confirm whether students accurately represented their motivation in their interviews. Building on these limitations, we suggest further research as follows. First, this was a pilot study with a small group of multi-ethnic students. Further studies are needed that address other multi-ethnic students' motivation changes over time. Studying a broader range of students might reveal cases showing increased motivation over time, which was not evident in our data. Also, further research could investigate students' actual classroom participation and include interviews with parents and teachers. The current study elicited only students' narratives to investigate their motivation from their perspectives. Although the narrative research methods allowed us to understand students' life events and perceptions, the methods did not provide detailed information of individual students' expectancy related beliefs and task values. Interviewing socializers and analyzing classroom participation might reveal nuances that were not visible in this study.

Although individual multi-ethnic students' achievement motivation and mathematics related life experiences differed, there are some common factors influencing their motivation development, especially (a) roles played by parents and teachers; (b) assessment of peers' competencies; (c) past learning experiences related to mathematics curriculum; (d) perception of the relationship between mathematics

competency and other subjects; (e) home backgrounds; and (f) perceived task values. In this study, we achieved some insight into why some multi-ethnic students are willing to study hard to get good scores while others are uninterested in mathematics, and why some students are likely to pursue new mathematical tasks and persist despite challenges, while others easily give up studying mathematics in the face of adversity. The findings of this study shed light on the development of student motivation and can inform efforts to develop students' positive motivation, which might influence their mathematics achievement and success in school.

***Acknowledgement.**

The data of this study were collected for the first author's Master thesis. However, we used different theoretical framework and research methods to achieve different research goals.

References

Akiba, M., LeTendre, G. K., & Scribner, J. P. (2007). Teacher quality, opportunity gap, and national achievement in 46 countries. *Educational Researcher 36*(7), 369-387.

Atkinson, J. W. (1957). Motivational determinants of risk taking behavior. *Psychological Review 64,* 359 - 372.

Atkinson, J. W. (1964). *An introduction to motivation*. Princeton, NJ: Van Nostrand.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review 84*(2), 191.

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development 72*(1), 187 - 206.

Berger, J. L. & Karabenick, S. A. (2011). Motivation and students' use of learning strategies: Evidence of unidirectional effects in mathematics classrooms. *Learning and Instruction 21*(3), 416 - 428.

Black, L., Williams, J., Hernandez-Martinez, P., Davis, P., Pampaka, M., & Wake, G. (2010). Developing a 'leading identity': The relationship between students' mathematical identities and their career and higher education aspirations. *Educational Studies in Mathematics 73*(1), 55 - 72.

Carey, J. W., Morgan, M., & Oxtoby, M. J. (1996). Intercoder agreement in analysis of responses to open-ended interview questions: Examples from tuberculosis research. *CAM Journal 8*(3), 1-5.

Clandinin, D. J. (2006). Narrative inquiry: A methodology for studying lived experience. *Research Studies in Music Education 27*(1), 44 - 54.

Clandinin, D. J., Pushor, D., & Orr, A. M. (2007). Navigating sites for narrative inquiry. *Journal of Teacher Education 58*(1), 21 - 35.

Creswell, J. W. & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Deci, E. & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Springer Science & Business Media.

Dweck, C. S. (2002). The development of ability conceptions. *Development of Achievement Motivation 17*, 57-88.

Eccles(Parsons), J. S., Adler, T. F., Futterman, R., Go, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence(Ed.), *Achievement and achievement motivation* (pp. 75 - 146). San Francisco, CA: W. H. Freeman.

Eccles, J. S. & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology 53*(1), 109 - 132.

Greene, B. A., DeBacker, T. K., Ravindran, B., & Krows, A. J. (1999). Goals, values, and beliefs as predictors of achievement and effort in high school mathematics classes. *Sex Roles 40*(5 - 6), 421 - 458.

Hansen-Thomas, H. (2008). Sheltered instruction: Best practices for ELL's in the mainstream. *Kappa Delta Pi Record 44*(4), 165 - 169.

Harter, S. (2006). The self. In W. Damon(Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of Child Psychology*(6th ed., Vol. 3)(pp. 505 - 570). New York: Wiley.

Harter, S., Whitesell, N. R., & Kowalski, P. (1992). Individual differences in the effects of educational transitions on young adolescent's perceptions of competence and motivational orientation. *American Educational Research Journal 29*(4), 777-807.

Ju, J. (2016). A study on education program for teenage student from multicultural families to decrease in the rate of school dropouts. *Journal of Social Welfare Management 3*(1), 91-113

Kloosterman, P. (2002). Beliefs about mathematics and mathematics learning in the secondary school: Measurement and implications for motivation. In G. C. Leder, E. Pehkonen & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 247 - 269). Dordrecht, The Netherlands: Kluwer.

Köller, O., Baumert, J., & Schnabel, K. (2001). Does interest matter? the relationship between academic interest and achievement in mathematics. *Journal for Research in Mathematics Education 32*(5), 448.

Metallidou, P. & Vlachou, A. (2007). Motivational beliefs, cognitive engagement, and achievement in language and mathematics in elementary school children. *International Journal of Psychology 42*(1), 2 - 15.

Middleton, J. A. & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education 30*(1), 65 - 88.

Ministry of Gender Equality & Family (2015). *An analysis on the national survey on multicultural families 2015*. Seoul. South Korea.

Niemiec, C. P. & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: applying self-determination theory to educational practice. *School Field 7*(2), 133 - 144.

Schiefele, U. & Csikszentmihalyi, M. (1995). Motivation and ability as factors in mathematics experience and achievement. *Journal for Research in Mathematics Education 26*(2), 163 - 181.

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *The Journal of Educational Research 95*(6), 323 - 332.

Stinson, D. W. (2013). Negotiating the "white male math myth": African-American male students and success in school mathematics. *Journal for Research in Mathematics Education 44*(1), 69.

Trautwein, U., Marsh, H. W., Nagengast, B., Lüdtke, O., Nagy, G., & Jonkmann, K. (2012). Probing for the multiplicative term in modern expectancy - value theory: A latent interaction modeling study. *Journal of Educational Psychology 104*(3), 763 - 777.

Wang, M. T., Eccles, J. S., & Kenny, S. (2013). Not lack of ability but more choice: Individual and gender differences in choice of careers in science, technology, engineering, and mathematics. *Psychological Science 24*(5), 770 - 775.

Wigfield, A. & Eccles, J. S. (2000). Expectancy - value theory of achievement motivation. *Contemporary Educational Psychology 25*(1), 68 - 81.

Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A. J., Freedman-Doan, C., & Blumenfeld, P. C. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. J*ournal of Educational Psychology 89*(3), 451

Wigfield, A., Tonks, S., & Klauda, S. T.(2009). Expectancy-value theory. In K. R. Wentzel & A. Wigfield(Eds.), *Handbook of Motivation at School*(pp. 55 - 75). New York, NY: Routledge.

다문화가정 학생의 수학학업성취 동기 변화 연구: 기대가치 이론에 따른 종단연구

조은혜
140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA
E-mail : eunhye.cho@bc.edu

황성환†
140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA
E-mail : hwangsl@bc.edu

이 연구의 목적은 기대-가치모델(Wigfield & Eccles, 2000)을 통해 여섯 명의 다문화학생들의 수학 학업성취동기가 초등학교 6학년부터 중학교 2학년 (2012~2014) 동안 어떻게 변화하는지 탐구하는 것이다. 이러한 변화과정은 내러티브 탐구를 통해 분석하였다. 그 결과 학생들이 각자 다른 학업성취와 수학 관련 경험들을 가지고 있었으나, 이들의 수학학습 동기발달에 공통적으로 영향을 미치는 요인들을 도출할 수 있었다: (a) 부모와 교사의 역할, (b) 동료의 학업성취, (c) 과거학습 경험과 수학교육과정의 특성, (d) 수학 역량과 다른 과목에서의 역량 간 관계에 대한 인식, (e) 가정 배경, 그리고 (f) 학업 가치 인식 정도. 이 연구 결과는 특정 다문화학생들은 좋은 수학 성적을 얻기 위해 열심히 공부를 하는 반면 다른 학생들은 왜 그렇지 않은지, 또한 왜 특정 학생들은 수학 공부 중 어려움에 부딪혔을 때 계속해서 학습을 하거나 새로운 수학 과제를 찾아나가는 반면 다른 학생들은 쉽게 포기하는지에 대한 통찰을 얻을 수 있었다. 이 연구는 교육자와 부모들이 다문화학생들의 학업동기를 증가시키거나 지속하기 위해서 학생들을 고립된 개체로 보는 것이 아니라 수학 학습동기에 영향을 주는 주변인, 시간, 장소의 상호작용에 주의를 기울일 것을 촉구한다. 본 연구는 다문화학생들의 학습동기발달 과정을 탐구함으로써 이들이 학교에서 높은 수학 성취와 성공에 이루도록 기여할 수 있는 긍정적인 학습 동기 향상 방향을 제시했다는 것에 함의가 있다.

* ZDM분류 : C23
* MSC2000분류 : 97C30
* 주제어 : 학업성취동기, 기대 가치 이론, 다문화가정 학생
† Corresponding author

Exploring Changes in Multi-ethnic Students' Mathematics Achievement Motivation: A Longitudinal Study using Expectancy-Value Theory

Eunhye Cho
140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA
E-mail : eunhye.cho@bc.edu

Sunghwan Hwang†
140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA
E-mail : hwangsl@bc.edu

The goal of this study was to apply an expectancy-value model(Wigfield & Eccles, 2000) to explain changes in six multi-ethnic students' achievement motivation in mathematics during sixth (2012) to eighth (2014) grades. In order to achieve this goal, we used narrative research methods. Although individual students' achievement motivation and mathematics related life experiences differed, there are some common factors influencing their motivation development, especially (a) roles played by parents and teachers; (b) assessment of peers' competencies; (c) past learning experiences related to mathematics curriculum; (d) perception of the relationship between mathematics competency and other subjects; (e) home backgrounds; and (f) perceived task values. In this study, we achieved some insight into why some multi-ethnic students are willing to study hard to get good scores while others are uninterested in mathematics, and why some multi-ethnic students are likely to pursue new mathematical tasks and persist despite challenges, while others easily give up studying mathematics in the face of adversity. We argue that in order to increase and sustain multi-ethnic students' achievement motivation, educators and parents should recognize that motivation is contextually formulated in the intersection of current people, time, and space, not a personal entity formed in an individual's mind. The findings of this study shed light on the development of achievement motivation and can inform efforts to develop multi-ethnic students' positive motivation, which might influence their mathematics achievement and success in school.

* ZDM : C23
* MSC2000 : 97C30
* Keyword: Achievement motivation, Expectancy-value theory, Multi-ethnic student
† Corresponding author