Strategies for Improving the Affective Characteristics of Korean Students Based on the Results of PISA and TIMSS

- Research Director: Seung Hyun Choe
- Research Co-authors: Joo-Hoon Kim, Eun-Soon Oh, Ja-Ok Ku, Sangwook Park, Hyunah Baek, Jaewoo Kim(Seoun Middle School)
I. Significance of the Study

Korea has been participating in the Trends in International Mathematics and Science Study (TIMSS) since 1995, which is conducted by the International Association for the Evaluation of Educational Achievement (IEA). In addition, Korea has taken part in the Programme for International Student Assessment (PISA) since 2000, which is in the charge of the Organization for Economic Cooperation and Development (OECD). In the two international achievement assessments, TIMSS and PISA, Korean students showed high academic achievements in reading, mathematics and science subjects bringing attentions from all over the world. However, their achievements in the affective domains have been reported to be very low.

It is necessary to pursue the optimal system to develop the affective characteristics of elementary and middle school students in Korea. To achieve this, extracting agreement about the definitions and factors of the affective achievements from PISA and TIMSS and investigating correlation between the various background variables and affective characteristic factors, such as interest, self-efficacy, and value, from the international achievement tests are necessary. Based on these results, we can implement practical and substantial ways to improve the affective characteristics of Korean students and recommend support plans and policy as well.

II. Purpose of the Study

To extract the affective characteristics of Korean students, such as interest, self-efficacy and value in mathematics and science from the results of PISA and TIMSS and to examine the relationship among educational context variables, such as teaching and learning as well as the educational environment of Korea

To examine the causes of low affective achievements, develop a program to improve the affective characteristics of mathematics and science, and propose the support plans and policy drafts to develop the affective characteristics
III. Contents and Method of the Study

Contents of the Study

• Extraction of the affective characteristics in mathematics and science included in PISA and TIMSS, study on the relevant theories and previous research, and analysis of the relationship between the affective characteristics and the educational context variables

• Analysis of the current situation and demand for education of affective characteristics in Korea and collection/analysis of domestic and foreign excellent cases

• Preparation of the teaching guidelines to develop affective characteristics in mathematics and science education and to develop the programs for developing the affective characteristics that can be utilized in creative experiential activities or after-school activities

• Suggestion of support plans and policies for development of affective characteristics
### Method of the Study

- **Literature Review**: Extraction of the affective characteristics in mathematics and science included in PISA and TIMSS and study on the relevant theories and previous research
- **Statistical Analysis**: Analysis of the relationship between the affective characteristics and the educational contextual variables based on the questionnaire survey results
of PISA 2003/2006 from students, schools, and parents as well as those of TIMSS 2007/2011 questionnaire survey results from students, teachers, and schools

- Examination and Analysis of Domestic and Foreign Excellent Cases: Collection and analysis of the excellent cases in developing and supporting affective characteristics according to each educational contextual variable derived from PISA and TIMSS analysis results
- Classroom Observation and In-depth Interview: Research on the reason behind the low affective achievements of Korean students revealed by PISA and TIMSS results, analysis of demands, and search for alternatives

IV. Preparation of Theoretical Basis for Affective Characteristics

- By exploring the relevant theories and previous research, the concepts of interest, self-efficacy, and value were defined, and their relationship with learning was investigated.
  - Interest was classified into subject-specific interest, personal interest, and ontological interest.
  - Self-efficacy was classified into proficient experiences, substitute experiences, verbal persuasion, and physiological and emotional situation.
  - Value was classified into attainment value, effective value, and intrinsic value.

- Through the exploration of definitions of interest, self-efficacy, and value as well as their development, it was explained that each element develops with the influence of birth factors, learning factors, and learning environment factors of the students.
  - The educational significance of the affective characteristics is that they wield great influence on task selection, participation in learning, performance, efforts, and continuance in learning process of the students.
  - Teaching guidelines and supporting plans were derived from previous research according to each of the three affective characteristics
Research trends in related fields were explored with regard to the relationship of the interest, self-efficacy, and value with the mathematics and science education in addition to effective teaching strategies.

V. Study on the Domestic Situation and Demand through Literature Review and Statistical Analysis of PISA and TIMSS Results

Previous studies on PISA and TIMSS result analysis were reanalyzed and the relationship between the affective characteristics and contextual variables shown in the two assessments results were statistically analyzed. The analysis results showed that the effects of teachers and schools on the affective characteristics in mathematics and science of the students were greater in middle and high schools than in elementary schools and higher in male students than in female students.

• In mathematics, variables including the attitude toward school, the number of books at home, class participation, inexperience in group bullying, relations with teachers, utilization of learning strategies, participation in female teacher class, frequency of homework, utilization of homework in during class, utilization of classroom materials, exchange between the teachers, reflection of teaching contents in assessment, and participation in mathematics-related activities had positive effects on affective characteristics of the students, while teachers’ participation in expertise development activities had a negative effect on their self-efficacy.

• In science, variables including the number of books at home, interest of parents, attitude toward school, class participation, science-related activities, awareness in environmental issues, awareness in importance of science subject, school preparation for science-related jobs, science activities after school, preference of parents for science-related jobs, individual science learning hours had positive effects on the affective characteristics of the students while the personal values of the parents in science had rather negative effects on their affective characteristics.
VI. Analysis of the Current Situation and Extraction of Alternatives through Analysis of Domestic Excellent Cases

To analyze the situation of affective characteristics education and to collect excellent cases in Korea, elementary, middle, high, and integrated elementary-middle schools where the affective characteristics are being taught in an exemplary manner were selected through recommendations from educational experts.

The analysis contents were established based on teaching and support principles of the three affective characteristics extracted from the theoretical research. The situation of affective characteristics education in mathematics and science in elementary and middle schools was diagnosed in terms of curriculum, teaching and learning, assessment, school environment, and social environment. Excellent cases were suggested as the alternatives for each situation diagnosed.

VII. Extraction of the Methods and Policy Alternatives to Develop Affective Characteristics through the Analysis of Excellent Cases in Foreign Countries

Among the countries that have continuously recorded high performance in PISA both in academic achievements and affective achievement, Canada and Singapore were selected as they are internationally recognized in the education of affective aspects. In-depth interview, classroom observation, and analysis of excellent cases were conducted in each of the two countries.

As the result of interview and observation, information and excellent cases in teaching and learning, assessment methods, and school environments that deeply considered the affective characteristics of the students were collected. Moreover, meaningful improvements were suggested by foreign educators who recognized the limits of Korean education.
VIII. Method to Develop Affective Characteristics Based on Research Results

Based on theoretical research, PISA and TIMSS result analysis, domestic situation and excellent case analysis, and foreign excellent cases analysis results, methods to develop Korean students’ affective characteristics were explored. Teaching guidelines and programs for the teaching of mathematics and science were developed, and related support plans were suggested.

- Teaching principles for each affective characteristic were drawn from theoretical research. Each principle led to teaching guidelines of affective characteristics for mathematics and science, and for elementary and middle schools. Each teaching guideline include not only topics and activities with which the teachers can properly apply the teaching principles to class but also at least one case of teaching principle application.
- Program development plan that will be used as a foundation of subsequent studies include the purpose and direction of program development, contents and system of the program, as well as the procedure of program development.
- Support plans are suggested for schools and society to reinforce the teaching of affective characteristics derived above. Support plans include developing expertise of school principals and teachers, changing the awareness of the persons concerned, establishing school climate and environment, improving national curriculum, and promoting social changes.

IX. Policy and Promotion Plans Suggestions

Improvements in Curriculum

- Promotion plans are suggested for the inclusion of affective characteristics education in curriculum and textbook development guidelines as well as for thorough consideration of learning psychology in the process of curriculum and textbook development.
Improvements in Teaching and Learning, and Assessment

- As a policy to innovate teaching and learning, and assessment for the establishment of affective characteristics education, promotion plans are suggested for the innovation of teaching and learning to develop the affective characteristics in subjects and for the supplementation of interest, self-efficacy, and value in educational assessment.

Support within Schools

- As a policy to strengthen the support of schools for reinforcement of affective characteristics education, promotion plans are suggested for enhancement of principal and teacher support for implementation of affective characteristics education, construction of physical and psychological environments for affective characteristics education, and strengthening of administrative and financial support for human, physical, and psychological changes.

Teacher Training

- As a policy to strengthen teacher training system for development of affective characteristics of students, promotion plans are suggested for the change of the teacher training from theory-focused training to practice-focused advanced training, and for implementation of in-service teacher training that emphasizes their field experience in the affective characteristics education.

Social Change

- As a policy to encourage social change, promotion plans are suggested for encouraging social change through multidirectional approaches, such as PR of the importance of affective characteristics education, mitigation of the weight in teacher training, and content supplementation of teacher training.
Pleasant Study, Happy School, and Valuable Life

Interest, Self-efficacy, and Value

Strengthening of affective characteristics education in elementary and middle school curriculum and textbooks

- Inclusion of the contents of affective characteristics education in curriculum and textbook development guidelines
- Thorough consideration of learning psychology in curriculum and textbook development process

Innovation of teaching & learning and assessment method for establishment of affective characteristics education

- Innovation of teaching and learning methods for development of affective characteristics in subjects
- Supplementation of the contents of interest, self-efficacy, and value in educational assessment

Strengthening of the support of schools to reinforce affective characteristics education

- Enhancement of principal and teacher support for implementation of affective characteristics education
- Establishment of physical and psychological environments to reinforce affective characteristics education
- Strengthening of the administrative and financial support for human, physical, and psychological changes

Strengthening of teacher training system to develop the affective characteristics of students

- Change of teacher training from theory-focused training to practice-focused advanced training
- Implementation of in-service teacher training that emphasizes the field experiences in affective characteristics education

Promotion of social changes to establish environments for affective characteristics in educational environment education

- Establishment of social environments through multidirectional approaches

Figure 2: Policy and Promotion Plans for Development of Affective Characteristics