Chapter 13:
Cognitive Development in Middle Childhood

Prepared by
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From Papalia, Olds, and Feldman
Piagetian Approach: Concrete Operational Child

- Cognitive Advances
  - Spatial thinking
  - Cause and effect
  - Categorization
  - Seriation and transitive inference
  - Inductive and deductive reasoning
  - Conservation
  - Number and mathematics

- Influences of Neurological Development and Schooling

- Moral Reasoning
Cognitive Advances

Space and Causality

- Better understand space
- Clearer idea of how far things are
- Remember route and landmarks
- Experience is important
- Ability to understand maps & models
- Ability to predict improves for levers and balance scales
  - Influence of physical attributes first
  - Influence of spatial factors second
Cognitive Advances

**Categorization**

- **Seriation**
  - According to one or more dimensions
    - Length: shortest to longest

- **Transitive inference**
  - Infer relationship between two objects
    - If A is bigger than B and B is bigger than C, A is bigger than C

- **Class inclusion**
  - Relationship of whole and parts
Class Inclusion: Flowers (Age 7/8)

More Daisies or More Flowers
Cognitive Advances

**Inductive and Deductive Reasoning**

- **Inductive (simple, concrete operations):** experimental thinking, specific to general, statistical probability
  - Second stack of blocks
  - My dog barks, her dog barks, so all dogs bark

- **Deductive (complex, premise, formal operations):** computational thinking, general to specific
  - First stack of blocks
  - All dogs bark, Spot is a dog, Spot barks
Deductive or Inductive?

Ball- Bearings

There are three machines designed to each produce one ounce ball-bearings. One machine is defective and produces 1.1 ounce ball-bearings. You are allowed to only make one weighing of any combination of ball bearings in any number from any machine. How can you determine which machine is defective?
Cognitive Advances

**Conservation**

- Need to understand identity
- Need to be able to reverse
- Need to decenter
- Three types:
  - Mass
  - Weight
  - Volume
- Concept of horizontal decalage
  - Inability to transfer learning about one type of conservation to other types
    - Child masters different types of conservation at different ages
Cognitive Advances

*Number and Mathematics*

- By 6/7 years
  - Children count in their heads
  - Count on
    - To add 5 + 3 start counting at 5
    - May take another 2 – 3 years to reverse: subtract
  - Better at solving simple story problems
    - Easier if they know what function to perform and how much original number was
  - Intuitive procedures not taught in school but easier to learn (culture)
Cognitive Advances

Number and Mathematics

• Basic fractions intuitive, complex formulas later
  – Difficulty understanding combinations of fractions
    • $\frac{1}{2} + \frac{1}{3} = \frac{2}{5}$ (initial thinking)
    • Later learn to convert to common denominator $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$
    • Difficulty with smaller denominator, bigger piece

• Estimation progresses with age
  – Number line estimation, computational estimation, numerosity estimation, measurement estimation
Influences of Neurological Development and Schooling

- Shift from rigid, illogical thinking of early childhood to logical, flexible thinking depends on brain development and experiences.
- Children who conserve volume have different brain waves from those who cannot yet conserve volume.
  - Suggests use of different brain regions.
- Today’s school children are not advancing through Piaget’s stages as rapidly as parents.
  - Indicates too much drilling and not enough hands-on experiences.
Moral Reasoning

• Younger children think the more damage an action causes, the naughtier the child
  – In spite of intent
    • Augustus helping filling his father’s ink pot makes big spot
    • Julian playing with ink pot makes small spot
    • Young children say Augustus was naughtier

• Immature moral judgments center on the degree of the offense, not considering intent
Moral Reasoning

• Piaget: moral reasoning occurs in 3 stages
  1. Rigid obedience to authority (2 – 7 years)
  2. Increasing flexibility (7 – 11 years)
  3. Equity (11 – 12 years and up)
Kohlberg’s Moral Reasoning

- Based on dilemmas
  - Heinz’ dilemma
  - Posed to boys aged 10, 13, 16 and more than 30 years later
  - Heart of each dilemma was justice

- Work began in 1950s

- Later modified by Carol Gilligan to reflect gender value differences, and later Gilligan modified her own assertions
  - Gilligan initially said girls see morality in terms of responsibility to show caring and avoid harm instead of justice and fairness

- Prosocial behavior and volunteer activity
Kohlberg’s Moral Reasoning

• Level I: Preconventional morality
  – Obey rules to avoid punishment or get reward
  – 4 – 10 years

• Level II: Conventional morality
  – Internalized standards of authority figures, want to be “good”, please others, maintain social order
  – 10 years
  – Black/white thinking, many never move beyond

• Level III: Postconventional morality
  – Recognize conflict between standards, make own judgments, based on own principles and beliefs
  – 14 years, if ever
Information-Processing Approach: Attention, Memory, and Planning

- How Do Executive Skills Develop?
- Selective Attention
- Working Memory Span
- Metamemory: Understanding Memory
- Mnemonics: Strategies for Remembering
- Information Processing and Piagetian Tasks
How Do Executive Skills Develop?

• Executive function:
  – Regulate and sustain attention
  – Process and retain information
  – Plan and monitor behavior

• Prefrontal cortex
  – Allows planning, judgment, decision making

• Home environment
  – Quality, cognitive stimulation, maternal sensitivity predicted attention and memory performance in first grade
Selective Attention

• School-age children:
  – Can concentrate longer
  – Can focus on the information they need and want
  – Can screen out irrelevant information
  – Fifth graders better than first graders at choosing what information to keep and what to discard
    • Name of a pet in a movie may be discarded

• Selective Attention:
  – Ability to deliberately direct attention to and shut out distractions
    • Relies on executive function of inhibitory control and suppression of unwanted responses
  – Due to neurological maturation
Working Memory Span

• Increases greatly in middle childhood
• Lays the foundation for wide range of cognitive skills
• Improvements in processing speed
• Improvements in storage capacity
Metamemory: Understanding Memory

- Between 5 and 7 years, frontal lobes develop significantly and reorganize.
- Metamemory improves: knowledge about the processes of memory:
  - First graders know that you remember better if you study longer.
  - First graders know that people forget things with time.
  - First graders know that relearning something is easier than learning it for the first time.
  - Third graders know that some people remember better than others.
  - Third graders know that some things are easier to remember than others.
Mnemonics: Strategies for Remembering

• Devices that aid memory are called mnemonic strategies

• Most common strategy for children and adults: external memory aids
  – Make a list, set a timer, put in physical location

• Other strategies:
  – Rehearsal: conscious repetition
  – Organization: form mental categories
  – Elaboration: imagine a scene or story
    • Young children benefit from our elaboration; older children make their own so it’s meaningful to them
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Definition</th>
<th>Development in Middle Childhood</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>External memory aids</td>
<td>Prompting by something outside the person</td>
<td>5- and 6-year-olds can do this, but 8-year-olds are more likely to think of it.</td>
<td>Dana makes a list of the things she has to do today.</td>
</tr>
<tr>
<td>Rehearsal</td>
<td>Conscious repetition</td>
<td>6-year-olds can be taught to do this; 7-year-olds do it spontaneously.</td>
<td>Ian says the letters in his spelling words over and over until he knows them.</td>
</tr>
<tr>
<td>Organization</td>
<td>Grouping by categories</td>
<td>Most children do not do this until at least age 10, but younger children can be taught to do it.</td>
<td>Luis recalls the animals he saw in the zoo by thinking first of the mammals, then the reptiles, then the amphibians, then the fish, and then the birds.</td>
</tr>
<tr>
<td>Elaboration</td>
<td>Associating items to be remembered with something else, such as a phrase, scene, or story</td>
<td>Older children are more likely to do this spontaneously and remember better if they make up their own elaboration; younger children remember better if someone else makes it up.</td>
<td>Yolanda remembers the lines of the musical staff (E, G, B, D, F) by associating them with the phrase “Every good boy does fine.”</td>
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</tbody>
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Information Processing and Piagetian Tasks

• Information processing helps explain Piaget’s advances in cognitive processes
• Improvements in memory may contribute to mastery of conservation
• Case, neo-Piagetian theorist, suggests as a child’s application of a concept or scheme becomes automatic, it frees space in working memory
  – Explains horizontal decalage
Psychometric Approach: Assessment of Intelligence

• The IQ Controversy
• Influences on Intelligence
• Is There More Than One Intelligence?
• New Directions in Intelligence Testing
The IQ Controversy

• WISC-III most widely used individual test that measures intelligence
  – Ages 6 – 16
  – Measures verbal and performance abilities
• Stanford-Binet Intelligence Scale also used
• Otis-Lennon School Ability Test (OLSAT8)
  – Kindergarten – grade 12
• IQ scores in middle childhood fairly good predictors of school achievement
  – But may not tell potential
• Tests are timed so penalizes a deliberate child
• Doesn’t measure native ability, infers intelligence from what children know, influenced by schooling, culture, and family
Influences on Intelligence: Genes and Brain Development

• Moderate correlation between brain size and general intelligence, especially reasoning and problem solving abilities
  – Remember: males have more gray matter

• One study found gray matter in frontal cortex is largely inherited, varies widely among individuals

• Another study suggests key is not amount of gray matter but pattern of development of prefrontal cortex
  – In the most intelligent 7-year-olds, cortex doesn’t peak in thickness until 11 or 12 years
    • Opposed to 8 years in children with average IQ

• Reasoning, problem solving, executive function linked to prefrontal cortex, other grain regions with strong genetic influence contribute to intelligent behavior, as well as speed and reliable transmission of messages

• Family, school, culture play a role as well
Influences on Intelligence

Influence of Schooling on IQ

• School increases tested intelligence
  – Delayed starting of school decreases IQ and may not catch up
• IQ scores drop during summer vacation
Influences on Intelligence

*Influences of Race/Ethnicity on IQ*

- Average test scores for black children historically lower by 15 points
  - Gap has narrowed in recent years
- Average IQ scores of Hispanic children are between black and white children
- While genetics influence individual intelligence, no evidence indicates ethnic, cultural, or racial group differences
- IQ differences largely or entirely attributed to inequalities in environment
  - Income, nutrition, living conditions, health, parenting, early child care, intellectual stimulation, schooling, culture, oppression, discrimination
    - Affects self-esteem, motivation, academic performance
- High SES strengthens genetic influence, low SES overrides it
Influences on Intelligence

Influence of Culture on IQ

- Cultural bias: tendency to include questions that use vocabulary or ask for information or skills more familiar to some cultural groups than others
- Intelligence tests may be built around dominant thinking style and language of white people or European ancestry
  - Minority children put at disadvantage
- Test developers have tried to design culture-free tests
  - Unable to eliminate all cultural influences
- Now produce culture-fair tests
- Sternberg says intelligence and culture are inextricably linked
  - Behavior seen intelligent in one culture may be viewed as foolish in another
  - Defines successful intelligence as the skills and knowledge needed for that society or culture
Gardner’s Theory of Multiple Intelligences

- Gardner, neuropsychologist and educational researcher at Harvard University originally identified 7 distinct kinds of intelligence
  - Conventional intelligence tests tap only three: linguistic, logical-mathematical, and spatial
  - Other four: musical, bodily-kinesthetic, interpersonal, intrapersonal
  - Later added 8th: naturalist
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<tr>
<td>Linguistic</td>
<td>Ability to use and understand words and nuances of meaning</td>
<td>Writing, editing, translating</td>
</tr>
<tr>
<td>Logical-mathemtical</td>
<td>Ability to manipulate numbers and solve logical problems</td>
<td>Science, business, medicine</td>
</tr>
<tr>
<td>Spatial</td>
<td>Ability to find one’s way around in an environment and judge relationships between objects in space</td>
<td>Architecture, carpentry, city planning</td>
</tr>
<tr>
<td>Musical</td>
<td>Ability to perceive and create patterns of pitch and rhythm</td>
<td>Musical composition, conducting</td>
</tr>
<tr>
<td>Bodily-kinesthetic</td>
<td>Ability to move with precision</td>
<td>Dancing, athletics, surgery</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Ability to understand and communicate with others</td>
<td>Teaching, acting, politics</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Ability to understand the self</td>
<td>Counseling, psychiatry, spiritual leadership</td>
</tr>
<tr>
<td>Naturalist</td>
<td>Ability to distinguish species and their characteristics</td>
<td>Hunting, fishing, farming, gardening, cooking</td>
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Is There More Than One Intelligence?

*Sternberg’s Triarchic Theory of Intelligence*

• Triarchic theory of intelligence: three elements
  – Componential: analytic aspect, solve problems, monitor solutions, evaluate results
  – Experiential: insightful or creative, how approach novel or familiar tasks, think originally
  – Contextual: practical, how you deal with environment, size up a situation and decide what to do: adapt, change, or get out of situation

• Tacit knowledge: not formally taught but necessary to get ahead (Scammon Bay)
New Direction in Intelligence Testing

- Sternberg Triarchic Abilities Test (STAT) new
- Kaufman Assessment Battery for Children evaluates diverse cognitive needs and abilities for children with autism, hearing impairments, language disorders, and various cultures and linguistic backgrounds
- Dynamic tests based on Vygotsky’s theories
- Identifying what a child is ready to learn, dynamic testing may be useful
  - But conventional psychometric tests will remain dominant
Language and Literacy

- Vocabulary, Grammar, and Syntax
- Pragmatics: Knowledge about Communication
- Literacy
Vocabulary, Grammar, & Syntax

- Vocabulary grows, use of precise verbs
  - Hitting
  - Slapping
  - Striking
  - Pounding
- Learn words have more than one meaning
  - Run
- Simile and metaphors common
- Syntax more sophisticated
  - “Caleb promised Debbie to wash the dishes” is understood that Caleb will wash the dishes
- Use of subordinate clauses
  - The boy *who delivers the newspapers* rang the doorbell
Pragmatics: Knowledge about Communication

• Major area of linguistic growth
  – Practical use of language to communicate
• Includes conversation and narrative skills
• Gender differences
  – Boys use more controlling statements and make more negative interruptions
  – Girls remarks are more tentative, conciliatory
• Stories have introductory information about setting and characters, talk about time and place, complex episodes as they mature
Literacy

Reading

- Children identify words one of two ways
  - Decode (sound out, phonics)
  - Visually based retrieval (whole language)
    - Uses contextual cues
    - Popular but research doesn’t support claims
  - Many experts recommend blending of both approaches
- Early reading difficulties may be overcome
  - Social skills associated with achievement
Literacy

**Writing**

- Writing goes hand in hand with reading
- Difficult for young children
  - Must think about spelling, punctuation, grammar, capitalization as well as forming the letters
- Vygotsky’s model suggests children work in pairs for better solutions to problems and fewer syntax errors
The Child in School

• Entering First Grade
• Influences on School Achievement: An Ecological Analysis
Entering First Grade

- School is a major formative experience
- School helps children:
  - Gain knowledge
  - Develop skills
  - Develop social competence
  - Stretch their bodies and minds
  - Prepare for adult life

- 3 out of 4 US children go to kindergarten
  - Some are eager; some are anxious

- Positive correlates with achievement
  - Interest, attention, active participation
Best Outcomes for First Graders

- At-risk 1\textsuperscript{st} graders (low SES, academic problems, attention problems, behavior problems) progressed when:
  - Teachers offered strong instructional and emotional support
    - Frequent literacy instruction
    - Evaluative feedback
    - Engaging students in discussions
    - Responding to their emotional needs
    - Encouraging responsibility
    - Creating positive classroom environment
Influences on School Achievement
An Ecological Analysis

Self-Efficacy Beliefs

• Bronfenbrenner predicts a child’s characteristics, immediate family, classroom environment, messages children receive from peers and larger culture influences school outcome.

• Students high in self-efficacy more likely to succeed.

• Self-regulated learners set challenging goals and use appropriate strategies to achieve them, try hard, persist, seek help when necessary.

• Students who don’t believe in themselves become frustrated and depressed.
Influences on School Achievement: An Ecological Analysis

*Gender*

- Girls:
  - Tend to do better in school than boys
    - Less likely to repeat grades
    - Have fewer school problems
    - Outperform boys in national reading and writing assessment
    - Aim for mastery of subject matter
    - Better classroom behavior
    - Adopt more effective strategies for learning
    - Better on times tests
  - Have less confidence in abilities
Influences on School Achievement: An Ecological Analysis

Gender

• Boys:
  – More interested in how smart they look in class
  – Advantage in spatial skills
    • SES makes a difference
      – High SES boys do better than high SES girls
      – Low SES boys did not do better than low SES girls
Influences on School Achievement: An Ecological Analysis

Parenting Practices

• Parents of achieving children create an environment for learning
  – Place to study
  – Books and supplies
  – Set times for meals, sleep and homework
  – Monitor television
  – Show interest in children’s lives
  – Talk with them about school and being involved in school activities

• Parents who are involved in schools have children who do better in school

• Use intrinsic motivation (more effective)

• Authoritative parenting
Socioeconomic Status

• Powerful factor in educational achievement
  – Family atmosphere
  – Choice of neighborhood
  – Parenting practices
  – Presence or absence of stress
  – Stability of household
  – Chaos versus order
  – Can affect parents’ ability to provide an environment that enhances learning

• SES not the only factor in school achievement
  – Households who use intrinsic motivation
  – Social capital: networks of community resources
Peer Acceptance

• Children who are liked and accepted by peers do better in school

• Children who are not liked by peers:
  – Have poorer academic self-concepts
  – More symptoms of anxiety or depression
  – Lower reading and math grades
The Educational System

• Educational philosophies have conflicted
  – “Child-Centered”
  – “Three R’s”
  – “Back to the basics”
  – No Child Left Behind (NCLB)

  • Emphasizes accountability, parental options, expanded local control and flexibility
  • 50 national education, civil rights, children’s and citizens groups have called for substantial changes
    – NCLB emphasizes punishment rather than assistance for failing school
    – Rigid, largely unfunded mandates rather than support for proven practices
    – Standardized testing rather than teacher-led, classroom-focused learning
The Educational System

- Students learn better when taught in a variety of ways.
- Students learn better when emphasizing creative and practical skills as well as memorization and critical thinking.

Sternberg’s Triarchic Theory

- Componential Intelligence: Ability to think abstractly, process information effectively.
- Experiential Intelligence: Ability to formulate new ideas, to combine seemingly unrelated facts or information.
- Contextual Intelligence: Ability to adapt to changing environmental conditions and to shape the environment, so as to maximize one’s strengths and compensate for one’s weaknesses.
The Educational System

School Environment

- Children learn better and teachers teach better in:
  - Comfortable, healthful environment
  - Small class size
    - Especially in early grades
    - Findings are mixed
The Educational System

• Current Educational Developments
  – Social promotion
    • Some loved the change
    • Others warned it could lead to lowered expectations, poor performance, dropping out of school
    • Chicago’s public schools retention policy did not improve third graders’ test scores, hurt sixth graders’ scores and greatly increased eighth-grade and high school dropout rates for retained students
  – Identify at-risk students early and intervene before they fail
    • Alternative schools, programs for at-risk students, smaller classes, remedial instruction, counseling, crisis intervention, summer school
The Educational System

• Some parents home school
  – Legal in all 50 states
  – 1.1 million US students homeschooled

• Some parents choose charter schools
  – 1 million US children attend charter schools
  • Tend to be smaller
  • Have unique philosophy, curriculum, structure, or organizational style
  • Parents generally satisfied
  • Studies on effects on student outcomes have mixed results
The Educational System

Computer and Internet Use

- 2003 91% children and adolescents used computers at home or school
- 59% used the Internet
  - Fewer black, Hispanic, and American Indian children
  - Fewer poor children
- Focus on “visual literacy”
- Children need to critically evaluate information
Educating Children with Special Needs

• Second-Language Education
• Children with Learning Problems
• Gifted Children
Second-Language Education

• 2004 19% of US population spoke language other than English at home
  – Primary language Spanish
  – 5% have difficulty speaking English

• English-immersion approach (ESL): immersed in English in special classes

• Bilingual education: taught in two languages
  – Typically outperform all-English programs in English proficiency
  – Public opinion turned against, enrollment declined from 37% to 17%
  – Eliminated in 2002 as part of NCLB

• Dual-language learning
  – English- and foreign-speaking children learn together
Children with Learning Problems

Mental Retardation

- IQ <70
- Deficiency in age-appropriate adaptive behavior
  - Communication, social skills, self-care
  - Before age 18
- < 1% US children mentally retarded
- 30 – 50% cause unknown
  - Genetic disorders, traumatic accidents, prenatal exposure to infection or alcohol, environment
Children with Learning Problems

Learning Disabilities

• Dyslexia: Famous people
  – Nelson Rockefeller, former Vice President
  – Tom Cruise
  – Whoopi Goldberg
  – Cher
  – Nolan Ryan
  – Jay Leno
  – Albert Einstein

• 80% of children with learning disabilities are dyslexic

• Runs in families
Children with Learning Problems

**Learning Disabilities**

- Dyslexia most commonly diagnosed learning disability
- Often near-average or higher-than-average intelligence
- Difficulty processing sensory information
- Genetic

- Less task oriented
- More easily distracted
- Less likely to use memory strategies
- Some haven’t been taught properly
- Some are anxious
- Some have trouble reading or hearing direction
- Some lack motivation or interest
- Some have developmental that may disappear
Children with Learning Problems

Hyperactivity and Attention Deficits

• Most common mental disorder in childhood
  – Chronic
  – Inattention
  – Distractibility
  – Impulsivity
  – Low tolerance for frustration
  – Too much activity at the wrong time in the wrong place

• 3 – 7% US school children (disputed)
  – May be underdiagnosed or overdiagnosed
Children with Learning Problems

Hyperactivity and Attention Deficits

• Famous people
  – John Lennon
  – Senator Robert Kennedy
  – Robin Williams
  – Sylvester Stallone

• Genetic, heritability 80%
  – Gene-environment interaction

• Inattention persists after impulse control and hyperactivity declines

• Academic problems, cumulative family stress, troubled peer relationships

• Drugs (not under 6), behavioral therapy, counseling, training
Children with Learning Problems

Educating Children with Disabilities

- 13% of US children in special education
  - IDEA
    - FAE (free appropriate education)
    - LRE (least restrictive environment)
    - IEP (individualized education plan)
    - Due process (if you don’t agree)
  
- 45% have learning disabilities
- 17% speech or language
- 9.5% mental retardation
Gifted Children

Identifying Gifted Children

- Akira Kurosawa (movie director): backwards
- Sir Isaac Newton (physicist, mathematician, astronomer): did poorly in school
- Thomas Edison (inventor): “too stupid to learn”
- Winston Churchill (British PM): failed 6th grade
- Enrico Caruso (tenor): told he could not sing
- 6% student population gifted
- Some are globally gifted, some are gifted in one area
  - Gardner’s intelligences
Gifted Children

*What causes Giftedness?*

- Strong intrinsic motivation
- Years of rigorous training
- Naturally occurring endowed ability
- Tend to grow up in enriched family environments
  - Intellectual or artistic stimulation
  - Parents recognize and nurture child’s gifts and promote independence
  - Parents have high expectations, hard workers, high achievers themselves
- Born with unusual brains that enable rapid learning in a particular domain
Gifted Children

*Lewis M. Terman and the Lives of Gifted Children*

- Longitudinal study of gifted children
  - Identified 1500 California children with IQs of >135 (top 1%)
  - None grew up to be illustrious
    - Lack of close correlation between high IQ and adult eminence
  - Profoundly gifted >180 social and emotional difficulties
Gifted Children

Defining and Measuring Creativity

• Guilford: two kinds of thinking
  – Convergent
    • IQ tests measure, single correct answer
  – Divergent
    • Wide array of fresh possibilities
  – Critique: a child who scores high in creativity on a test may not be creative in everyday life
Gifted Children

Educating Gifted Children

• 68% of schools have special programs for gifted children
  – Enrichment
    • Deepens knowledge and skills
    • Extra classroom activities
    • Research projects
    • Field trips
    • Expert coaching
  – Acceleration
    • Speed up education
Gifted Children

- Julian Stanley: Seeking and Nurturing the Profoundly Gifted
  - Selected even more gifted children than Terman
  - Didn’t use IQ but college entrance examinations
  - Vast majority of children/participants said accelerating education promoted academic progress and social-emotional development
Knowing others is intelligence. Knowing yourself is true wisdom.

-Lao Tse