Intelligence and Mental Ability

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Introduction
- Intelligence refers to the abilities involved in learning and adaptive behaviour
- Intelligence tests
  - Designed to measure a person’s general mental abilities
- But what exactly what makes up intelligence?

Definition of Intelligence
- Global capacity to think rationally, act purposefully, and deal effectively with the environment

Theories of Intelligence
Theories of Intelligence

- Charles Spearman – “g” factor
- Louis Thurstone - Intelligence as a person’s “pattern” of mental abilities
- Raymond Cattell - Clusters of intelligence
- Sternberg - Triarchic theory
- Howard Gardner - Multiple intelligences
- Daniel Goleman - Emotional Intelligence

Early Theories of Intelligence

- Charles Spearman (1863 – 1945)
  - Believed intelligence is general / global
  - People who are bright in one area are usually bright in other areas as well

- Louis Thurstone (1887 – 1955)
  - Believed that intelligence is made up of seven distinct, independent abilities
    - Spatial ability, perceptual speed, numerical ability, verbal meaning, memory, word fluency, and reasoning

- Raymond Cattell (1905 - 1998)
  - Identified two clusters of mental abilities
    - Crystallized intelligence includes abilities such as reasoning and verbal skills
    - Fluid intelligence includes skills such as spatial and visual imagery, rote memory, and the ability to notice visual details
  - While education can increase crystallized intelligence, it was not thought to have any effect on fluid intelligence
Contemporary Theories of Intelligence

- Robert Sternberg
  - Triarchic theory of intelligence posits three types of intelligence
  - Analytical intelligence includes the ability to learn how to do things, solve problems, and acquire new knowledge
  - Creative intelligence includes the ability to adjust to new tasks, use new concepts, and respond well in new situations
  - Practical intelligence includes the ability to select contexts in which you can excel and solve practical problems

- Howard Gardner’s Theory of Multiple Intelligences (8 so far . . . )
  - Gardner argues that each intelligence has
    - a unique biological basis,
    - a distinct course of development
    - different expert performances
  - Cultural values and learning opportunities
  - Not yet firmly grounded in research.
  - Helpful in efforts to understand and nurture children’s special talents.

Howard Gardner’s theory of multiple intelligences

- Logical-mathematical
- Linguistic
- Spatial
- Musical
- Bodily-kinesthetic
- Interpersonal
- Intrapersonal
- Naturalistic
Contemporary Theories of Intelligence

- Daniel Goleman
  - Proposed theory of Emotional Intelligence
  - Emotional intelligence has five components
    - Knowing one's own emotions
    - Managing one's own emotions
    - Using emotions to motivate oneself
    - Recognizing the emotions of other people
    - Managing relationships
  - http://www.eiconsortium.org/research/what_is_emotional_intelligence.htm

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Defining and measuring Intelligence

- Provide an overall score for general intelligence or reasoning ability, and an array of separate scores measuring specific mental abilities.
Alfred Binet (1857–1911)

- Intelligence—collection of higher-order mental abilities loosely related to one another
- Did not rank “normal” students according to the scores
- Binet-Simon Test developed in France, 1905
- Intelligence is nurtured

Intelligence Tests

- Binet-Simon scale
  - First test of intelligence, developed to identify children who might have difficulty in school
  - Binet developed the concept of mental age in children
- Stanford-Binet scale
  - L. M. Terman’s adaptation of the Binet-Simon scale
  - Terman introduced the I.Q. score
  - A score of 100 is considered average

Approximate Distribution of IQ Scores in the Population

Modern Intelligence Tests

The Stanford-Binet Scale

- Modification of the original Binet-Simon, after original came to US
- Intelligence Quotient (IQ) - mental age divided by chronological age
- Used widely in the US, not as much as previously
Intelligence Tests

- Stanford-Binet measures four kinds of mental abilities
  - Verbal reasoning
  - Abstract/visual reasoning
  - Quantitative reasoning
  - Short-term memory

Modern Intelligence Tests

- Types of tests:
  - Achievement test—designed to measure level of knowledge, skill, or accomplishment in a particular area
  - Aptitude test—designed to measure capability to benefit from education or training
  - Interest test—measures self-reported vocational interests and skills

Modern Intelligence Tests

- The Wechsler tests
  - Used more widely now than Stanford-Binet
  - Modeled after Binet's, also made adult test
    - WISC-IV for children
    - WAIS-III for adults

Standardized Scoring of Wechsler Tests

- All raw scores converted to standardized scores
- Normal distribution
- Mean of 100
- S.d. of 15
Wechsler Intelligence Scale for Children–IV

- The aggregate or global ability of the individual to think rationally, act purposefully and deal effectively with the environment.
- Ages 6- through 16-year-olds.
- Verbal IQ
- Performance IQ
- Full Scale IQ
- Mean = 100; SD 15
- Average 85-115

Intelligence Tests

- Group Tests
  - Intelligence tests that can be given to large groups
  - Advantages
    - Quick scoring
    - No examiner bias
    - Easier to establish norms
  - Disadvantages
    - Less likely to detect someone who is ill or confused
    - Might make people nervous
    - Learning disabled children often perform worse

- Performance tests
  - Tests that minimize the use of language
  - Used to test very young children or people with LD
  - Also can be used to test those unfamiliar with English

- Culture-fair tests
  - Tests designed to reduce cultural bias
  - Minimize skills and values that vary from one culture to another

Qualities of Good Tests

- Standardized
  - Administered to large groups of people under uniform conditions to establish norms

- Reliable
  - Ability to produce consistent results when administered on repeated occasions under similar conditions

- Valid
  - Ability to measure what the test is intended to measure
What Makes a Good Test?

- Reliability
  - Ability of a test to provide consistent and stable scores
  - Can measure reliability in two ways
    - Test-retest reliability – give the same test twice and compare scores
    - Split-half reliability – divide one test into two parts and compare the scores on each part

- Validity
  - Ability of a test to measure what it was designed to measure
  - Content validity
    - The extent to which test items represent the knowledge or skills being measured
  - Ecological validity
    - Relationship between scores on a test and an independent measure of what the test is supposed to measure

Criticisms of IQ Tests

- Test content and scores
  - Critics argue that IQ tests measure a narrow set of skills
  - Some feel that the tests merely measure test-taking ability
  - Tests may discriminate against minorities
- Use of intelligence tests
  - Could result in permanent labeling
- IQ and success
  - Relationship does exist, but may be the result of a self-fulfilling prophecy

Individual differences
What Determines Intelligence?

- Heredity
  - To what extent is intelligence inherited from parents?
  - Evidence from twin and adoption studies points to a genetic component for intelligence

Twin studies

- Adoption research
  - Estimates are that 50% of differences among children in IQ can be traced to their genetics
  - Poverty severely depresses the intelligence of large numbers of ethnic minority children.
  - Unique cultural values and practices do not prepare these children for intelligence tests.

Correlation of IQ Scores of Family Members

What Determines Intelligence?

- Environment
  - The environment in which one is raised can strongly affect intelligence
  - This can include proper nutrition and access to quality education as well as an enriching environment
### Nature - Nurture

- There is general agreement that both heredity and environment affect IQ scores.
- Debate centers around the relative contribution of nature (heredity) and nurture (environment) to the development of intelligence.

### Mental Abilities & Human Diversity

#### Gender
- Overall, men and women do not differ significantly in general intelligence.
- Women may show slight advantage in mathematical computation skills.
- Men show an advantage in spatial ability.
- Men are more likely to fall in the extremes of intelligence range.

### Cultural Influences

- Unique cultural values and practices do not prepare ethnic minority children for intelligence tests.
  - Language Customs
  - Familiarity with Test Content
  - People-oriented versus books, TV, video games

### Explaining Individual and Group Differences in IQ (US Studies)

- American black children score, on the average, 15 IQ points below American white children, although this difference is shrinking.
- Hispanic children fall midway between black and white children.
- The gap between middle-SES and low-SES children is about 9 points.
- There is considerable variation within each ethnic and SES group.
Extremes of Intelligence

- Learning Disabilities
  - Refers to a wide variety of mental deficits
  - Defined as significantly sub-average general intelligence functioning that is accompanied by significant limitations in adaptive functioning
  - Some people with LD show savant performance on particular skills

Learning Disabilities

<table>
<thead>
<tr>
<th>Level of Disability</th>
<th>IQ Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Low 50s-70s</td>
</tr>
<tr>
<td>Moderate</td>
<td>Mid 30s-low 50s</td>
</tr>
<tr>
<td>Severe</td>
<td>Low 20s-mid 30s</td>
</tr>
<tr>
<td>Profound</td>
<td>Below 20 or 25</td>
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</tbody>
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Extremes of Intelligence

- Giftedness
  - Refers to superior IQ combined with ability in academics, creativity, and leadership
  - Giftedness is often in specific areas
  - “Globally” gifted people are rare

Gifted Children

- Gifted children display exceptional intellectual strengths, including high IQ, keen memory, and an exceptional capacity to solve challenging problems rapidly and accurately.
  - High creativity
  - Divergent thinking
  - Convergent thinking
  - Talent.
  - Extreme giftedness often results in social isolation.
  - Many talented youths become experts in their fields, yet few become highly creative.
Educating the Gifted

- The extent to which programs for the gifted foster creativity and talent depends on opportunities to acquire relevant skills.
- Gardner’s theory of multiple intelligences has inspired several model programs that include all pupils.
- Evidence is still needed on how effectively these programs nurture children’s talents.
- These programs may be useful in identifying talented, low-SES minority children, who are underrepresented in school programs for the gifted.

Creativity

- Creativity can be defined as the ability to produce novel and socially valued ideas or objects.
- Creativity and intelligence
  - Intelligence and creativity are related, but only up to a certain threshold.
  - Above about 110 IQ they are virtually unrelated.
  - Creative people are often perceived as intelligent.

Creativity tests

- Open-ended questions are used.
- Scoring is based upon the number and originality of a person’s answers.

To enhance creativity:

- Creativity as a goal.
- Reinforce creative behaviour.
- Engage in problem finding.
- Acquire relevant knowledge.
- Try different approaches.
- Exert effort and expect setbacks.
References