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Academic and practical intelligence: A case study of the Yup'ik in Alaska

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Abstract

We assessed the importance of academic and practical intelligence in rural and relatively urban Yup'ik Alaskan communities with respect to Yup'ik-valued traits rated by adults or peers in the adolescents' communities. A total of 261 adolescents participated in the study; of these adolescents, 145 were females and 116 were males, and they were from seven different communities, six rural ($n = 136$) and one relatively urban ($n = 125$). We measured academic intelligence with conventional measures of fluid and crystallized intelligence. We measured practical intelligence with a test of everyday-life knowledge as acquired in Native Alaskan Yup'ik communities. Finally, we collected ratings from the adolescents' peers and adults on the traits that are valued by the Yup'ik people; thus, we evaluated the reputation for the Yup'ik-valued competences. The objective of the study was to estimate the relative contributions of conventional knowledge and everyday-life knowledge in predicting the ratings on Yup'ik-valued traits. The results indicated that everyday-life knowledge predicts Yup'ik-valued traits in the presented sample and that the predictive power of this knowledge is higher in adolescents (especially boys) from rural communities than from the semiurban community. The obtained result pattern further strengthens our arguments for the multidimensionality of human abilities and the importance of practical intelligence in nonacademic settings.

Keywords: Practical intelligence; Yup'ik communities; Problem solving

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1. Academic and practical intelligence: a brief review of the literature

Although psychologists and laypeople often think of intelligence as a unitary entity, various aspects of intelligence (e.g., intelligence demonstrated in a classroom and intelligence demonstrated in everyday life) may be somewhat distinct. One of the earliest psychologists to make this point was an experimental psychologist, Thorndike (1924), who argued that social intelligence is distinct from the kind of intelligence measured by conventional intelligence tests. Many others subsequently have made this claim as well about social and practical intelligences (see reviews in Kihlstrom & Cantor, 2000; Sternberg et al., 2000; Wagner, 2000). A related claim was made by a well-known psychometrician, Guilford (1967), who separated behavioral content from more typical kinds of test-like content in his theory of the structure of intellect. More recently, Gardner (1983, 1999) has argued that interpersonal and intrapersonal intelligences are distinct from the more academic ones (e.g., linguistic and logical–mathematical). Similarly, Mayer, Caruso, and Salovey (1999), and Mayer, Salovey, and Caruso (2000), and Salovey and Mayer (1990) further stressed the multidimensionality of intelligence, pointing out the separateness of emotional intelligence (see also Goleman, 1995).

Speaking generally, Neisser (1976) stated that the conventional wisdom accurately reflects two different kinds of intelligence, academic and practical. Implicit theories of intelligence, in the United States (Sternberg, 1985b; Sternberg, Conway, Ketron, & Bernstein, 1981) and elsewhere (Grigorenko et al., 2001; Sternberg & Kaufman, 1998; Yang & Sternberg, 1997), also suggest some separation of academic and practical aspects of intelligence. Although specifics of definitions of academic and practical intelligence vary between studies and cultures, the thrust of these notions remains the same: the concept of academic (analytical) intelligence is used to signify the person’s ability to solve problems in academic (classroom-like) settings, whereas the concept of practical intelligence is used to signify the person’s ability to solve problems in everyday settings (practical life problems). For children, aspects of classroom-like settings may invoke practical intelligence. For example, knowing the information for a test invokes largely academic intelligence, but knowing how to study for the test invokes a great deal of practical intelligence.

The psychological theory underlying the present research makes a similar claim, namely, for a distinction between analytical intelligence (or what Neisser refers to as “academic intelligence”) and practical intelligence (Sternberg, 1985a, 1988, 1997, 1999). According to Sternberg’s triarchic theory of successful intelligence, the basic information-processing components underlying abstract analytical and applied practical intelligence are the same (e.g., defining problems, formulating strategies, inferring relations, etc.). But differences in tasks and situations requiring the two kinds of intelligence, and hence in the concrete contexts in which they are used, can render the correlations between scores on tests of the two kinds of intelligence positive, trivial, or, in principle, negative (see Sternberg et al., 2000; Sternberg, Grigorenko, & Bundy, 2001). From the point of view of individual differences, people who well apply a set of processes in one context may not be those who well apply them in another context.

The issue in this article is not over whether analytical (academic) intelligence matters at all. We believe there is solid evidence that the kind of analytical intelligence measured by conventional kinds of intelligence tests predicts performance, at least to some degree, in a variety of situations (see Barrett & Depinet, 1991; Carroll, 1993; Gottfredson, 1997; Herrnstein & Murray, 1994; Hunter & Hunter, 1984; Jensen, 1998; Neisser et al., 1996; Schmidt & Hunter, 1981; Sternberg, Grigorenko et al., 2001; Wigdor & Garner, 1982; see also essays in Sternberg, 2000). Hence, we would not want to test for everyday-life intelligence (i.e., practical intelligence) *rather than* for conventional intelligence (i.e., academic intelligence; McClelland, 1973); instead, we might want to test for the practical form of intelligence *in addition* to the particularly academic form of intelligence, because both might predict various kinds of performance relatively independently. Our argument in this article is that both kinds of intelligence can be important in a variety of situations.

A growing body of empirical data suggests that there indeed may be a true psychological distinction between academic and practical intelligence (see Sternberg et al., 2000; Wagner, 2000). If there is, then conventional ability tests standing alone may tell us substantially less than we ideally would want to know about people's performance in the practical situations they encounter in their daily lives. We cite some of this evidence here, although more nearly complete reviews can be found in Sternberg et al. (2000), Sternberg, Wagner, Williams, and Horvath (1995), and Wagner (2000).

Denney and Palmer (1981) compared the performance of adults of diverse ages on two types of reasoning problems: a traditional cognitive measure and a problem-solving task involving real-life situations. The most interesting result of this study for our present purpose was that performance on the traditional cognitive (academic) measure decreased linearly after age 20 whereas performance on the practical problem-solving task increased to a peak in the 40- and 50-year-old age groups, and only then declined. Practical intelligence thus showed a developmental function over age more similar to crystallized than to fluid intelligence (Horn, 1994; Horn & Cattell, 1966).

A similar result was found by Cornelius and Caspi (1987), who explicitly looked at measures of fluid, crystallized, and practical intelligence. (The practical measures involved tasks, such as dealing with a landlord who would not make repairs, getting a friend to visit one more often, and what to do when one has been passed over for promotion.) Fluid abilities showed increases from about age 20 or 30 to age 50 and then declined. Crystallized and practical abilities increased until about age 70 before declining. However, the measures of practical abilities showed only modest correlations with both the fluid and crystallized ability measures, suggesting that the practical measures were assessing a distinct construct.

Scribner (1984) investigated strategies used by milk-processing plant workers to fill orders. She found that rather than employing typical mathematical algorithms learned in the classroom, experienced assemblers used complex strategies for combining partially filled cases in a manner that minimized the number of moves required to complete an order. Although the assemblers were the least educated workers in the plant, they were able to calculate in their heads quantities expressed in different base number systems, and they routinely outperformed the more highly educated white-collar workers who substituted when assemblers were absent. The order-filling performance of the assemblers was unrelated to measures of school performance, including intelligence-test scores, arithmetic-test scores, and grades.

Another series of studies of everyday mathematics involved shoppers in California grocery stores who sought to buy at the cheapest cost when the same products were available in different-sized containers. These studies were performed before cost-per-unit quantity information was routinely posted. Lave, Murtaugh, and de la Roche (1984) found that effective shoppers used mental shortcuts to get an easily obtained answer accurate (although not always completely accurate) enough to determine which size to buy. But when these same individuals were given a mental–arithmetic test that required them to do much the same thing in a paper-and-pencil format, there was no relation between their ability to do the paper-and-pencil problems and their ability to pick the best values in the supermarket.

Nuñes (1994) and Carraher, Carraher, and Schliemann (1985) have studied the performance of Brazilian street children in mathematical reasoning tasks (see also Ceci, 1996; Ceci & Roazzi, 1994). They found, similarly to Lave et al., that the same children who were able to solve arithmetical problems in the setting where they actually needed to use these operations in their daily lives were often unable to solve comparable problems presented to them abstractly in paper-and-pencil format. A similar finding emanates from the research of Wagner (1978), who showed that whereas Western adults did better than Moroccan rug dealers on a fairly abstract memory test, the rug dealers did better on tests of their memory for patterns on Oriental rugs.

In our own research (reviewed in Sternberg et al., 1995, 2000; Sternberg, Wagner, & Okagaki, 1993), we have investigated practical knowledge as it applies in a variety of occupations, including management, sales, teaching, and military leadership. We have devised tests of an aspect of practical intelligence, which is what one needs to know to succeed in a context of his or her everyday life. Specifically, we have constructed scenarios of the kinds people encounter in their daily lives in which the people face on-the-job problems that they need to solve. Participants in our studies then are typically presented with a variety of options for solving the problems. They are asked to rate the quality of each of the options, typically on a 1–9 scale. Responses are scored against those of experts. The closer the participant's profile is to the mean profile of the experts, the better the score on the test.

In a series of about a dozen studies extending over close to 15 years (see Sternberg et al., 2000), we have made a number of observations. Most relevant here are the observations that (a) practical-intelligence measures tend to correlate significantly with each other (Sternberg et al., 2000); (b) they correlate variably with measures of academic intelligence—sometimes positively, often not at all, and sometimes negatively (Sternberg, Grigorenko et al., 2001); (c) they tend to predict criteria of job success about as well as or at times even better than do indicators of academic intelligence, IQ (Sternberg et al., 2000); and (d) they predict job performance significantly, even when variables including IQ, personality, and styles of thinking are placed first into a hierarchical regression model (Sternberg et al., 2000). Here, we present only a number of studies especially relevant to the research presented in this paper.

Sternberg, Nokes et al. (2001) tested in rural adolescents of western Kenya the notion that academic and practical intelligence are separable and relatively distinct constructs. The main dependent variable of interest was the adolescents' scores on a test of their knowledge for natural herbal medicines used to fight illnesses. This kind of knowledge is viewed by the villagers as important in adapting to their environment, which is understandable given that the overwhelming majority of the children have, at a given time, parasitic infections that can interfere with their daily functioning. In other words, it is this type of knowledge that is relevant to the villagers' everyday life. We found that scores on the assessments of practical intelligence correlated trivially or significantly negatively with conventional measures of academic intelligence and achievement, even after controlling for socioeconomic status. Such a result is probably most likely in a society, such as that of rural Kenya, where implicit theories of intelligence depart greatly from Western explicit theories of intelligence. Indeed, Kenyan implicit theories of intelligence stress everyday skills far more than they stress academic ones (Grigorenko et al., 2001). Moreover, it has been shown that implicit theories of intelligence can affect the way people go about doing tasks in their academic as well as everyday lives (Dweck, 1999).

In another study, Grigorenko and Sternberg (2001) studied a large group of Russian adults living in a provincial city. We used conventional measures of intelligence as indicators of analytical intelligence and vignettes depicting everyday-life situations and self-ratings of behavior as indicators of practical intelligence. The indicators of analytical and practical intelligence were used to predict mental and physical health among the Russian adults. Mental health was measured by widely used paper-and-pencil tests of depression and anxiety and physical health was measured by self-report. The best predictor of mental and physical health was the practical-intelligence measure. Analytical intelligence came second.

Both contributed to prediction, however. Thus, we again concluded that theories of intelligence, to provide better prediction of success in life in a variety of domains (rather than in a single domain of school success), should encompass abilities important for everyday life as well as academic abilities.

Any one or even subsets of these findings might be criticized for one or another reason. But taken together, with their different strengths and weaknesses, the body of evidence suggests that the conventional wisdom that academic and practical intelligence are largely separate constructs may genuinely best represent the data that are currently available. If this is the case, then the general factor sometimes identified as central to intelligence needs to be viewed in a different way from the way it is conventionally viewed.

Claims of a general factor of intelligence, dating back to Spearman (1904) and continuing on to the present day (e.g., Carroll, 1993; Jensen, 1998; see essays in Sternberg & Grigorenko, 2002), then take on a different cast. This cast is that the general factor, to the extent it exists, may characterize academic forms of intelligence quite well, but may not extend as well beyond them. Our goal is not to argue whether there "really" is a general factor in human intelligence, because from our point of view, the question easily degenerates into a semantic one. If one defines intelligence somewhat more narrowly (e.g., Jensen, 1998), a general factor usually appears. If one defines intelligence somewhat more broadly (e.g., Gardner, 1983, 1999; Sternberg, 1985a), then it does not appear, or at least not with the full generality typically ascribed to it.

Our goal in the present study was to provide a further test of the hypothesis deriving from the triarchic theory of successful intelligence (Sternberg, 1985a, 1997; Sternberg et al., 2000) that academic and practical intelligence may be, from an individual-differences standpoint, largely distinct constructs. Continuing our attempt to survey various unindustrialized cultures (i.e., different from those where the concept of intelligence originated) for the distinction between these two types of intelligence, in the present study, we conduct research in the rural and relatively urban settlements of Alaska Natives,[1] Yup'ik people. The main objective of this study was to explain the ratings on Yup'ik-valued traits in the studied adolescents by their performance indicators on tests of analytical and practical intelligence. Once again, our argument in this article is that both kinds of intelligence can be important for predicting these traits of interest. Moreover, designing the study, we expected to see higher predictive power of the everyday-life knowledge in rural communities.

2. Yup'ik culture: a brief overview

The word Yup'ik means "real person" in the Yup'ik language. This language is still spoken among many of the Yup'ik people, who live primarily in the central and western portions of Alaska. They live mostly on flat, marshy, often frozen plains intersected by numerous bodies of water of the Yukon and the Kuskokwin Rivers, draining their waters through southwest Alaska westward into the Bering Sea. Alaska's Native Americans include three major groups: Eskimo-Inupiat (Inupiaq) and Yup'ik Inuit, Aleuts (Alutiq), and Indians (Athapaskans). Yup'ik Eskimo people are the largest group among Native Alaskans.

[1] The term Alaska Native is used in reference to Alaska's original inhabitants. Alaska Natives include three groups—Aleut, Eskimo, and Indian groups; the groups differ in terms of their ethnic origin, language, and culture.

Federal census data do not provide specific information on the number of Yup'ik people, because the data are broken down separately for Eskimos, Aleuts, and American Indians without differentiating between Yup'ik and Inupiat Eskimos. Thus, only approximate numbers are available (http://sled.alaska.edu). Specifically, the self-identified Eskimo population of Alaska in 1990 was 44,401, of whom 48.6% (21,619) lived in Yup'ik areas and 28.5% lived in Inupiat areas. Approximately 17.1% of the Eskimo population lived in cities of Alaska (Anchorage and Fairbanks) and 5.7% lived in other Alaskan locations. Other sources indicate that the size of Yup'ik population is about 21,000 people (http://www.uafedu/ancl/langs/cy.html).

Today's Yup'ik people live in modern houses with electricity, oil, telephone, and satellite TV. However, a large part of the culture of these communities' subsistence is through fishing and hunting (although most people now supplement their meals with store-bought food), and the culture remains highly intertwined with the natural environment (Lipka, Mohatt, & the Ciulistet Group, 1998). Temperatures in Yup'ik country range greatly, from as low as $-80\,^{\circ}$F. in the winter to as high as $80\,^{\circ}$F. in the summer (Fineup-Riordan, 1990). The ocean, rivers, and lakes are rich with fish; the tundra is rich with wildlife. Villages are situated at large distances from each other. Thus, living in rural Alaska calls for a variety of adaptive skills. Children are taught survival skills from an early age that long ago became largely irrelevant for most people living in North America and Europe. Those Yup'ik children who fail to learn these survival skills, fail at their own potential peril.

Social life among the Yup'ik people centers around the extended family and the community. Many Yup'ik live in small isolated communities, where we have done most of the work described in this article (as well as other work; see Sternberg, Lipka, Newman, Wildfeuer, & Grigorenko, 2004). During winter, most of these villages can be reached from other parts of Alaska only by airplane, because they are separated from each other by vast, difficult-to-travel tundra. Some choose to travel by snow-go (snowmobile), although doing so requires an intimate knowledge of the terrain, as there are no marked roads and visibility can change quickly with the weather.

In the summer, ships can land in the communities that are situated near water. Many of the Yup'ik live on modest income (because the main source of income often is through commercial fishing and hunting, both of which are season dependent and vary greatly annually in yield), and governmental economic assistance is commonplace.

Village men and women teach survival skills as well as traditional crafts. Elders are relied upon for their wisdom, and elders speak from time to time at community centers to communicate this wisdom. Thus, elders are viewed and treated as the source of traditional Yup'ik knowledge. One of the central elements of preserving the traditional Eskimo culture relates to the presentation of the Yup'ik language. However, only about 71% of the people in the Yup'ik areas speak the language. Yup'ik children and teenagers are faced with the difficult challenge of trying to negotiate two worlds—the more traditional world of the elders and the more modern world of outside. For example, children still grow up speaking Yup'ik as their first language in only 17 of 68 Yup'ik villages (http://www.uafedu/ancl/langs/cy.html).

As a group, Alaska Native children, along with other American Indian students, underperform in core academic subjects (e.g., NCES, http://nces.ed.gov/nationsreportcard/mathematics/results/scale-ethnic.asp). There are likely many reasons for this underperformance and the main effects and the interplay of these reasons are poorly understood.

As indicated above, the main objective of the study was to evaluate the predictive power of indicators of analytical intelligence (fluid and crystallized abilities) compared to that of indicators of practical intelligence with regard to peer and adult ratings of Yup'ik qualities among adolescents (boys and girls) living in the relatively urban community (Dillingham) and the rural communities (all the other locations) of Southern Alaska.

3. Method

3.1. Participants

There were a total of 261 participants rated by adults or peers in the study: 69 in Grade 9, 69 in Grade 10, 45 in Grade 11, 37 in Grade 12; 41 adolescents did not indicate their grade. Of the adolescents in the study, 145 were females (74 from the rural and 71 from the semiurban communities) and 116 were males (62 were from the rural and 54 were from the semiurban communities). They were from seven different Alaskan rural communities: Akiachak ($n=27$), Akiak ($n=21$), Dillingham ($n=125$), Manokotak ($n=17$), New Stuyahok ($n=22$), Togiak ($n=37$), and Tuluksak ($n=12$). All of these communities are small rural, primarily Yup'ik villages, except Dillingham, which is relatively urban (by Alaskan standards), although not a major urban area (such as Anchorage, Fairbanks, or Juneau).

The rural communities were all traditional Eskimo villages with a fishing and hunting subsistence lifestyle. At the time of the study, the largest village we worked in, Togiak, had a population of approximately 750 individuals, and the smallest village, Akiak, had approximately 280 individuals. Self-reported available data suggest that the percentage of residents in these villages who are Native Alaskans is 90–95%. The majority of the children in the villages come to school with greater proficiency in Yup'ik than in English.

Dillingham is a town located at the extreme northern end of Nushagak Bay in northern Bristol Bay. The current population of Dillingham is about 2500 people, of whom approximately 55.8% are Alaska Natives (Eskimo, Aleuts, and Indians). Dillingham is the economic, transportation, and public-service center for western Bristol Bay. The primary activities in Dillingham are fish processing, cold storage, and support of fishing industry. In Dillingham, although Yup'ik is spoken by adults in shops and homes, the level of proficiency among children and adolescents is low.

3.2. Materials

3.2.1. Independent variables

Independent variables were of two kinds—psychometric reference tests and our own measure, the Yup'ik Scale of Practical Intelligence (YSPI).

1. *Test of "g": Culture Fair, Scale 2, Form A*. This test (Cattell & Cattell, 1960) measures fluid abilities. The test consists exclusively of geometric-reasoning items. It has four subtests: series completions (12 items), classifications (14 items), matrix completions (12 items), and topology (8 items).
2. *Mill–Hill Vocabulary Scale—Junior Multiple Choice, U. S. Edition (1985 Revision), Forms A and B* (Raven, Raven, & Court, 1989; Raven, Court, & Raven, 1992). Each form consists of 1 practice item and 32 multiple-choice synonyms items. This test measures crystallized abilities.

3. *YSPI*. This test, developed especially for this study, has 36 multiple-choice items. The test assesses the presence of knowledge relevant to the participants' performance in situations encountered in everyday life of Yup'ik people and, therefore, relevant to adaptation in the primarily rural environment in which most of them live. The test measures everyday-life knowledge in various content areas, including gathering and processing herbs and berries, fishing and fish preparation, knowledge of weather and indigenous tradition, and hunting. Tests of practical everyday knowledge can be more domain general or more domain specific, and more population general or population specific. This particular test was designed primarily to be domain and population specific.

The procedure for creating such a test is described in Sternberg et al. (2000). The test was created in collaboration between researchers and local residents (including one of the coauthors of this article), based on extensive interviews. Because the test is unfamiliar, we present here example items from the test for each content area. An asterisk (*) indicates the correct response.

3.2.1.1. Herbs and berries. I can usually find the most *atsalugpiat* (cloudberries/salmonberries) in the:

(a) grass far from the water.
(b) hills that appear dry.
(c) hills that appear green.
(d) grass near a pond or marsh.*

3.2.1.2. Fishing and fish preparation. Julie likes to make *sulunaqs* (salted fish heads) for her family. *Sulunaqs* are made from:

(a) trout.
(b) pike.
(c) king.*
(d) tomcod.

3.2.1.3. Knowledge of weather. When Eddie runs to collect the ptarmigan that he's just shot, he notices that its front pouch (balloon) is full of ptarmigan food. This is a sign that:

(a) there's a storm on the way.*
(b) winter is almost over.
(c) it's hard to find food this season.
(d) it hasn't snowed in a long time.

3.2.1.4. Hunting. Uncle Markus knows a lot about hunting wolverines. He is most likely to catch a wolverine when he sets his trap:

(a) on a slanted tree.*
(b) in the hollow of a dead tree.
(c) far from any water.
(d) near a frozen river.

Since there were a relatively small number of items ($n = 36$), we constructed only two subscales of the YSPI—one indicating the knowledge of sea and river (e.g., fishing, fish preparation and preservation, weather in the sea—hereafter sea and river knowledge, 17 items) and the other indicating the knowledge of land (e.g., hunting, trapping, knowledge of herbs and berries and weather in tundra—hereafter land knowledge, 19 items).

3.2.2. Dependent variables

There were three major dependent variables pertaining to practical skills valued by Yup'ik people. The questions through which these dependent variables were operationalized were formulated after conducting over 30 interviews with the elders, adults, and adolescents in the rural Yup'ik communities, nominated by the communities members as "good Yup'ik people" (people living in Yup'ik ways). During the interviews, we asked the interviewees to identify qualities of the people that are valued the most by the community members; we also asked the interviewees to share with us stories about people or situations that illustrate these qualities. The interviews were audiotaped or videotaped and translated by one of the authors of this paper (EY). This qualitative investigation resulted in the formulation of the following questions aimed at capturing traits valued by traditional Yup'ik culture:

1. Of the adolescents on your list, who is the most *umyuartuli* (a good thinker, one who comes up with novel solutions to problems and uses the mind to survive)?
2. Which of the adolescents on your list is the most *qigcikluki tegganret* (respectful of elders)?
3. Who is the best
   3.1. *picul'i* (great hunter)? [for boys only]
   3.2. *cayunailnguq* (seamstress, cook, housekeeper)? [for girls][2]

These questions were asked both of adults (teachers and community leaders) and of peers of the adolescents. The methodology for collecting and analyzing these ratings was rather complex, because not all raters knew all adolescents to be rated. This procedure is described fully in Grigorenko et al. (2001). In brief, we used standardized units of comparison by dividing the sample of adolescents into triples[3] and implemented a formal strategy for quantifying individual differences.

The scoring procedure worked as follows. The raw data were in the form of combinations of "ones" and "zeros." The chosen adolescents were assigned a "one" (1), and the adolescents who failed to be chosen were assigned a "zero" (0). For example, consider a triple consisting of adolescents A, B, and C (triple 1). Suppose that Rater 1 selected Adolescent A as the best *umyuartuli* among the three adolescents he or she compared. Then, for this comparison, the data set would have a record of 1 for Adolescent A, and records of 0 for Adolescents B and C. Now, suppose that Rater 2 chose to compare adolescents in a triple consisting of participants A, B, and D (triple 2). Assume that

[2] Accidentally, one girl was evaluated for her hunting skills and three boys were evaluated for their household skills. These data were deleted from the analyses.

[3] The size of groups of adolescents to be compared (triples with $n = 3$) was determined by previous ethnographic and anthropological observations. The suggested method, however, is applicable to units of comparison of any size (pairs, quadruples, quintuples, etc.).

Rater 2 also selected Adolescent A as the best *umyuartuli*. Then the corresponding subset of the full data set has the following information:

	Adolescent	Triple	Score
Rater 1	A	1	1
	B	1	0
	C	1	0
Rater 2	A	2	1
	B	2	0
	D	2	0

This information can be recoded so that every occurrence of a 1 reflects a probability of being chosen as best in a given triple. Thus, for the triple 1, where rows dominate columns,

	A	B	C
A		1	1
B	0		
C	0		

and for triple 2,

	A	B	D
A		1	1
B	0		
D	0		

In other words, given that a triple of a given structure (A, B, and C) was evaluated by a given rater (e.g., Rater 1), the probability of Adolescent A being chosen was 1, whereas for Adolescents B and C, it was 0. There was no information about the probability of Adolescent B being chosen over Adolescent C (or vice versa); therefore, these points in the table were recoded as missing data points. Similarly, when Adolescent A was evaluated in the A-B-D triple, he was also chosen over Adolescents B and D; there was no information about the probability of Adolescent B being chosen over Adolescent D (or vice versa).

At the next stage, the data were converted into the format of pairwise comparisons (i.e., A versus B, A versus C, B versus C, A versus D, B versus D, and D versus C). The probabilities of a given adolescent being chosen in a given pair were summed over the total sample and then averaged by the number of comparisons of a given pair [in the example above, the pair A versus B was compared twice, in the triple 1 (A, B, and C) and in the triple 2 (A, B, and D); therefore, the probability of A being chosen over B is $(1+1)/2=1$]. The number of comparisons for each pair was recorded as a separate variable. Thus, the data have a two-way structure: adolescent and comparison adolescent. There are, however, many missing data points because not every adolescent is paired with every other adolescent. Yet, multiple comparisons provide enough information to elicit adolescent-based parameter estimates.

Therefore, the recoded data reflecting the probability that a given adolescent would be chosen over another adolescent in a given pair when a certain number of comparisons were carried out were subjected to analysis of variance. In this analysis, we obtained parameter estimates indicating the variability in ratings attributable to individual differences between adolescents on a given trait. These parameter estimates were saved and then were treated as dependent variables in subsequent analyses. In other words, each adolescent now had a quantitative indicator of a skill on which he or she was compared to his peers. The internal properties of this analysis were evaluated by means of components-of-variance analysis (specifically, the variance components due to adolescent, comparison adolescent, and error were estimated).

The ratings were generated separately for peers and adults. To reduce the dimensionality of the indicators and to minimize measurement error, we applied principal-component analyses to indicators generated in the analysis of variance described above (e.g., hunting skills indicators obtained from comparisons produced by adults and hunting skills indicators obtained from comparisons produced by peers). The factor scores from the first principal components were saved and used in subsequent analyses. Specifically, the ratings of adults and peers shared 60% of the variance for Question 1 (hereafter the factor score on the first principal component is referred as an indicator of thinking skills); 65% for Question 2 (hereafter referred as an indicator of respect for elders); 73% for Question 3 for boys (hereafter referred as an indicator of hunting skills); and 68% for Question 3 for girls (hereafter referred as an indicator of household skills).

3.3. Design

All participants were expected to receive all measures. The design was thus planned to be fully within-subjects. However, not all raters rated all individuals (and, indeed, they could not because they were from different communities), so the ratings matrix was incomplete (see Grigorenko et al., 2001). Moreover, not all adolescents who were rated (dependent variable) were available to be tested with the psychometric measures used in the study (or vice versa). For this reason, actual n values are given with each data analysis or reflected in P values.

3.4. Procedure

Adolescents were tested in schools or community centers in small groups. The practical-intelligence test (YSPI) was administered first, then the tests of fluid and crystallized abilities. Finally, adolescents provided ratings. Adults who provided ratings did so at schools or community centers. All testing of adolescents was done with parental informed consent as well as the adolescents' assent.

4. Results

4.1. Reliabilities

Coefficient α (internal-consistency) reliabilities for our main measures were .81 for the Cattell for the total score (.51 for series completions, .49 for classifications, .71 for matrix completions, and .69 for topology), .92 for the Mill–Hill for the combined forms (.82 for Form A and .88 for Form B), and .72

for the YSPI. The YSPI measured very diverse elements of practical knowledge across multiple domains (as described above), which is why its internal consistency would be expected to be, and was, lower (internal consistency was .58 for sea and river knowledge and .57 for land knowledge). The Cattell was speeded, so its α internal-consistency reliability was somewhat suppressed.

4.2. Basic statistics

Table 1 shows basic statistics for all indicators used in the study.

4.3. Group comparisons

4.3.1. Independent variables

To investigate the group differences, we carried out a series of multivariate and univariate analyses of variance. The first multivariate model included the total indicators of fluid, crystallized, and practical abilities and investigated the main effect of location (rural and semiurban), the main effect of gender (boys and girls), and the interaction between the two effects; the main effect of the location and the interaction effect (Location × Gender) were significant [Pillai's Trace=.324, $F(3,161) = 25.7$, $P < .001$ and Pillai's Trace=.052, $F(3,161) = 2.9$, $P < .05$). The univariate effects of location were significant for all dependent variables [$F(1,163) = 5.6$, $P < .05$, $F(1,163) = 28.7$, $P < .001$, and $F(1,163) = 15.3$, $P < .001$, for the Cattell, Mill–Hill, and YSPI, respectively]. However, there was only one significant effect

Table 1
Descriptive statistics

Subgroup measure	Rural boys	Semiurban boys	Rural girls	Semiurban girls	All boys and girls
	Mean/S.D.				
The Cattell Culture Fair					
(1) Series completions	9.1/1.7	9.3/2.5	8.7/1.6	9.4/1.6	9.0/1.8
(2) Classifications	7.8/1.8	8.7/2.3	7.7/1.8	8.5/2.3	7.8/2.0
(3) Matrix completions	7.8/2.4	8.8/3.3	8.1/2.2	8.8/1.7	8.1/2.5
(4) Topology	4.0/2.1	4.9/2.3	3.9/2.0	4.1/2.2	4.1/2.1
(5) Total score	28.6/5.5	31.4/8.4	28.4/5.1	30.5/6.2	29.2/5.9
The Mill–Hill Vocabulary Test					
(1) Form A	16.6/3.4	21.5/3.3	17.1/3.9	19.6/3.6	17.8/3.9
(2) Form B	15.4/4.4	20.8/7.3	16.8/4.1	19.2/5.9	17.2/5.2
(3) Total scores	32.0/7.1	42.1/9.0	34.0/7.4	38.2/8.5	35.0/8.3
The YSPI					
(1) Sea and river knowledge	9.5/2.8	6.7/2.7	8.9/2.7	6.6/2.2	8.5/2.9
(2) Land knowledge	9.1/2.8	8.3/3.9	8.6/2.3	8.7/3.3	8.7/2.8
(3) Total scores	18.6/4.4	15.1/6.0	17.4/3.7	15.1/4.2	17.2/4.5
The Criteria Ratings					
(1) Thinking skills	.53/.94	.25/.74	− .45/.91	.21/.1.0	.10/1.0
(2) Respect for elders	.11/1.0	− 0.21/1.0	− .07/.93	.08/.93	− .01/1.0
(3) Hunting skills	.18/1.1	− .19/.82			.05/.99
(4) Household skills			− .22/1.1	.32/.85	.03/1.0

pertaining to the interaction of location and gender, specifically for the Mill–Hill total score [$F(1,163)=4.7$, $P<.05$]. Further analyses of the means indicated specific details of the differences between the means for the Mill–Hill indicators [Subset 1 included semiurban boys and girls; Subset 2—semiurban and rural girls; Subset 3—rural boys and girls; $F(3,166)=10.4$, $P<.001$] and practical abilities scores [subset 1 included rural boys and girls; subtest 2—rural girls and semiurban boys and girls; $F(3,166)=5.7$, $P<.001$]. This pattern of results, in general, holds for the subtests of the three abilities (see Table 1). Overall, rural boys and girls outperformed semiurban boys and girls on indicators of practical intelligence while underperforming on indicators of conventional intelligence; rural boys demonstrated the highest level of performance on the YSPI and the lowest on the Mill–Hill.

4.3.2. Dependent variables

Because of the sample composition of the dependent variables (the hunting skills indicators were collected only for boys and the household skills indicators were collected only for girls), we conducted three different sets of analyses. The first set of multivariate analyses investigated the location, gender, and Location × Gender differences for thinking skills and respect for elders indicators. Here, the multivariate effects of gender and Location × Gender were significant [Pillai's Trace = 0.073, $F(2,187)=7.3$, $P<.001$ and Pillai's Trace=.063, $F(2,187)=6.3$, $P<.01$, respectively]. However, the univariate analyses indicated that there was a significant effect of gender and Location × Gender only for the thinking skills variable [$F(1,188)=13.9$, $P<.001$ and $F(1,188)=9.7$, $P<.001$, respectively]. Specifically, the comparison of the means indicated that the rural boys outperformed everyone else, but rural girls did the worst [$F(3,191)=12.1$, $P<.001$]. The other two analyses were univariate analyses for boys and girls separately. For the indicator of hunting skills, rural boys outperformed urban boys, but the F statistic was only borderline significant [$F(1,88)=3.1$, $P<.1$]. For the indicator of household skills, urban girls outperformed rural girls [$F(3,132)=10.3$, $P<.001$].

4.4. Correlations

Tables 2 and 3 show first-order correlations between all indicators used in the study (descriptive statistics for these variables are presented in Table 1). Table 2 presents the correlations for the total sample, whereas Table 3 presents the correlations for the two subsamples (rural and semiurban) of adolescents. The discussion of these tables is concurrent.

4.4.1. Between measures of fluid and crystallized abilities

Based on past research and conventional hierarchical models (e.g., Carroll, 1993), we predicted that the two conventional psychometric ability tests would show a significant correlation with each other, which they did. The correlation was .48 for the total scores ($P<.001$, $n=175$). The correlations between the subtests were of comparable magnitude and are shown in Table 2. Table 3 presents the correlations between the same variables, but obtained for the two different groups of adolescents.

4.4.2. Between the practical-intelligence measure and measures of fluid and crystallized abilities

Based on our own past research (see, e.g., Sternberg et al., 2000), we predicted that correlations between our practical-intelligence measure (YSPI) indicators and measures of fluid and crystallized abilities would be modest and positive or nil. We were largely but not entirely correct in this prediction.

Table 2
Intercorrelations

Indicators	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
The Cattell Culture Fair												
Series completions (1)	1											
Classifications (2)	.48***	1										
Matrix completions (3)	.47***	.40***	1									
Topology (4)	.24***	.27***	.28***	1								
The Mill–Hill Vocabulary Test												
Form A (5)	.36***	.31***	.38***	.33***	1							
Form B (6)	.35***	.30***	.27***	.26***	.68***	1						
The YSPI												
Sea and river knowledge (7)	.12	.08	.09	.14	.08	.08	1					
Land knowledge (8)	.14	.08	.16*	.08	.12	.21**	.46***	1				
The Criteria Ratings												
Thinking skills (9)	.17*	.19**	.10	.19*	.23**	.24**	.07	.17*	1			
Respect for elders (10)	.17*	.09	.20**	.03	.09	.07	.08	.09	.16*	1		
Hunting skills (11)	−.16	−.20	−.06	−.02	.04	−.13	.39***	.35***	.29**	−.14	1	
Household skills (12)	.24*	.16	.27**	.02	.14	.21*	−.17	.09	.38***	.37***	N/A	1

*$P < .05$.
**$P < .01$.
***$P < .001$.

Table 3
Intercorrelations in the two groups of adolescents

Indicators	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
The Cattell Culture Fair												
Series completions (1)	1	.59***	.60***	.45***	.25	.17	.13	.08	.05	.06	− .10	.32
Classifications (2)	.38***	1	.47***	.41***	.30*	.16	.08	− .06	.34*	.09	− .06	.26
Matrix completions (3)	.37***	.33***	1	.27*	.28*	.16	.18	.11	− .03	.17	− .17	.36*
Topology (4)	.10	.15	.28**	1	.37**	.24	.34*	.14	.12	− .13	.19	.24
The Mill–Hill Vocabulary Test												
Form A (5)	.41***	.26**	.38***	.29***	1	.44***	.24	.09	.25	− .09	.10	.36*
Form B (6)	.44***	.33***	.28**	.22*	.72***	1	.22	.19	.29*	.01	− .16	.22
The YSPI												
Sea and river knowledge (7)	.22*	.21*	.16	.13	.35***	.31***	1	.54***	− .09	.13	.23	− .03
Land knowledge (8)	.22*	.26**	.24**	.06	.31***	.37***	.33***	1	.01	.04	.19	.01
The Criteria Ratings												
Thinking skills (9)	.19*	.08	.11	.20*	.17	.17	.23**	.33***	1	.07	.05	.43**
Respect for elders (10)	.19*	.05	.19*	.07	.11	.08	.05	.13	.20*	1	− .41**	.36*
Hunting skills (11)	− .19	− .24	.02	− .06	.14	− .05	.39***	.39***	.34**	− .06	1	N/A
Household skills (12)	.13	.04	.18	− .12	− .09	.08	− .07	.25*	.23	.39***	N/A	1

Correlations shown below the diagonal were obtained in the rural sample; correlations shown above the diagonal were obtained in the semiurban sample.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

The correlations between the subtests of the YSPI, Mill–Hill, and Cattell are shown in Table 2. For the total sample, of the 12 correlations of YSPI with the Mill–Hill and Cattell tests, only 2 were significant, both with land knowledge, one with an indicator of fluid and one with an indicator of crystallized intelligence. Consistent with previous data (reviewed in Sternberg et al., 2000), correlations between measures of practical and crystallized intelligence are nonsignificant or trivial statistically. The reason is that crystallized intelligence tests measure knowledge valued by the elite of a society (e.g., vocabulary words that generally are used only rarely in conversations, factual information that is rarely called upon in daily life, and reading comprehension for passages that are above the level of many readers) and practical-intelligence tests measure knowledge valued by the general population in everyday life. Thus, someone could have high practical intelligence, but achieve rather modest scores on tests, such as the Verbal SAT or the Miller Analogies Test, both of which require, for mastery, a level of verbal sophistication beyond that of many people in the population.

The correlations for the two groups of the adolescents (rural and semiurban) are shown in Table 3.

4.4.3. Between the subscale indicators of the YSPI

The two subscales of the YSPI correlated with each other at r=.46 ($P<.001$) for the total sample. The correlations in the two groups of adolescents—those living in the rural and those living in the semiurban environments—are shown in Table 3.

4.4.4. Between the four ratings of practical skills

Recall that there were four relevant ratings of practical skills: everyday thinking skills, respect for elders, hunting skills (for boys), and household skills (for girls). The correlations between the four criteria indicators for the total sample are shown in Table 2. The results, in general, reveal a positive manifold in the relations between these skills. In other words, these results suggest that the four ratings are assessing related skills, but certainly not the same skills.

The correlations for the two groups of the adolescents (rural and semiurban) are shown in Table 3.

4.4.5. Between conventional psychometric measures (fluid/crystallized) and ratings of practical skills

We expected modest but probably significant correlations between the conventional psychometric measures and the ratings of adaptive skills, given that *g* predicts so many things (Jensen, 1998). The data were generally consistent with this prediction.

As apparent from Table 2, for the total sample, most of the significant correlations between peer and adult ratings and indicators of fluid and crystallized intelligence were observed for the thinking skills ratings. It is also of interest that hunting skills in boys did not correlate with any conventional intelligence indicators. Table 3 depicts the pattern of correlations between the ratings and the indicators of the conventional intelligence in the two subsamples of adolescents.

Overall, these results suggest that the conventional psychometric measures provide modest prediction of some rated skills (e.g., thinking skills and respect for elders), but not others (e.g., hunting skills) valued by Yup'ik people.

4.4.6. Between the practical-intelligence measure (YSPI) and ratings of practical skills

The correlations between the indicators of YSPI and the ratings are shown in Table 2 (for the total sample) and in Table 3 (for subsamples). In general, the results suggest that our practical-intelligence measure (YSPI) provided modest prediction of adaptive skills as expressed by ratings of adults and peers in the total sample (thinking skills and hunting skills) and moderate prediction of adaptive peer and adult ratings among the rural adolescents (thinking skills, hunting skills, and household skills).

4.5. Structural equation modeling

To further investigate the patterns of observed relationships between independent and dependent variables, we have fitted a number of structural equation models. In these models, we attempted to predict peer and adult ratings of the Yup'ik-valued traits based on indicators of fluid, crystallized, and practical abilities. However, although the parameter estimates appear to be robust, because of the relatively small sample sizes, the results presented below should be interpreted with caution.

4.5.1. Full model for the total sample combined with missing data

As indicated above, there were missing data points in this dataset. Moreover, ratings of hunting skills were obtained for boys only whereas ratings of household skills were obtained for girls only. To avoid listwise deletion, the covariance matrix for these measures was estimated using the full-information maximum likelihood (FIML; Allison, 1987; Dempster, Laird, & Rubin, 1977; McArdle, 1994) method as implemented in Mplus (Muthén & Muthén, 2002). Specifically, we fitted the MIMIC model to the data (Muthén & Muthén, 2002). In this model, we specified three latent variables, each of which was determined by multiple indicators. In detail, the fluid intelligence latent structure was determined by four subtests of the Cattell; the crystallized intelligence latent structure was defined through two forms of the Mill−Hill; and the practical-intelligence latent variable was defined by the two indicators of the YSPI (sea/river knowledge and land knowledge). The four criteria ratings—thinking skills, respect for elders, hunting skills, and household skills—were regressed on the three latent variables.

First, we fitted the model (Model 1) without subgrouping (i.e., without indicating the rural versus semiurban subsamples). The overall fit of the model was satisfactory—$\chi^2(37) = 35.7$ (P=.53), compared to the fit for the baseline model—$\chi^2(60) = 417.2$ (P=.00). The model's CFI was 1.00 and its SRMR was .037. Fig. 1 presents the structure of the model and depicts standardized coefficients. As presented in Fig. 1, the R^2 for the latent variables were .14 for fluid intelligence, .10 for crystallized intelligence, and .29 for practical intelligence. The correlations between the latent structures were as follows: fluid intelligence correlated with crystallized intelligence at .55 ($t = 4.8$), whereas practical intelligence correlated with fluid intelligence at .27 ($t = 2.5$) and with crystallized intelligence at .19 ($t = 1.8$). The specific parameter estimates for this and all other models are presented in Table 4.

Second, we fitted the model (Model 2) that specified the structure of rural versus semiurban subsamples. The overall fit of the model was also satisfactory—$\chi^2(84) = 85.4$ (P=.44), compared to the fit for the baseline model—$\chi^2(120) = 488.7$ (P=.00). The model's CFI was .996 and its SRMR was .071. Because Model 1 showed a comparable satisfactory fit and was more parsimonious than this model, preference should be given to the simpler model (i.e., the model presented in Fig. 1). Of interest, however, is whether the loadings in the two groups (rural and semiurban) were different for any variables (as the correlations for some variables differed across the subsamples of rural and semiurban adolescents, as is apparent from Table 3). Table 4 presents the parameter estimates for the two models of interest. The R^2 for the latent variables were (1) .20 for fluid intelligence, .06 for crystallized intelligence, and .53 for practical intelligence in the rural sample and (2) .14 for fluid intelligence, .28 for crystallized intelligence, and .05 for practical intelligence in the semiurban sample. The correlations between the latent structures were as follows: (1) fluid intelligence correlated with crystallized intelligence at .64

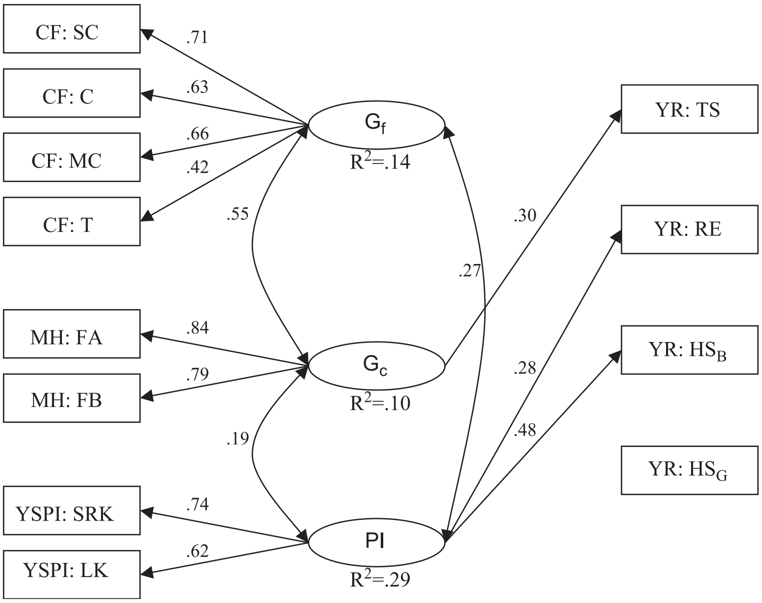

Fig. 1. A diagram for Model 1. CF: SC—The Cattell subtest series completions; CF: S—The Cattell subtest classifications; CF: MC—The Cattell subtest matrix completions; CF: T—The Cattell subtest topology; MH: FA—The Mill–Hill subtest Form A; MH: FA—The Mill–Hill subtest Form B; YSPI: SRK—Yup'ik Scale of Practical Intelligence subtest sea/river knowledge; YSPI: LK—Yup'ik Scale of Practical Intelligence subtest land knowledge; YR: TS—Yup'ik ratings, thinking skills; YR: TS—Yup'ik ratings, respect for elders; YR: HS_B—Yup'ik ratings, hunting skills; YR: HS_G—household skills. Note: Only statistically significant coefficients are shown.

($t=4.5$), whereas practical intelligence correlated with fluid intelligence at .67 ($t=4.1$) and with crystallized intelligence at .66 ($t=4.4$) in the rural subsample and (2) fluid intelligence correlated with crystallized intelligence at .31 ($t=1.8$), whereas practical intelligence correlated with fluid intelligence at .15 ($t=1.1$) and with crystallized intelligence at .36 ($t=2.6$) in the semiurban subsample. These differences in the patterns of correlations are of interest, but should be interpreted with caution, because the size of the samples on which these correlations were obtained are small and the standard errors for these correlations are not available.

4.5.2. Group-specific modeling

Because the full model was fitted with missing data (i.e., only boys were rated for hunting skills and only girls were rated for household skills), we refitted the two models specified above (Models 1 and 2) to boys- and girls-only data.

4.5.3. Boy-specific models

As described above, we first fitted a model that replicated the model described above, with one exception—the trait of household skills was absent from the model. In other words, Model 1 was refitted for boys only and without the household skills variable. All fitting indices for this model were satisfactory: $\chi^2(32)=27.7$ (P=.69), compared to the fit for the baseline model—$\chi^2(52)=239.9$ (P=.00). The model's CFI was 1.00 and its SRMR was .050. The model (Model 3) resulted in the following R^2 for

Table 4
Parameter estimates from the fitted S.E.M. models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CF: series completions	.71	.64/.83	.75	.69/.87	.68	.60/.81
CF: classifications	.63	.57/.68	.69	.64/.74	.59	.53/.66
CF: matrix completions	.66	.55/.70	.73	.62/.76	.58	.41/.62
CF: topology	.42	.35/.50	.34	.28/.43	.46	.40/.58
MH: Form A	.84	.84/.78	.78	.80/.84	.83	.87/.70
MH: Form B	.79	.85/.54	.89	.87/.61	.77	.85/.48
YSPI: sea and river	.74	.61/1.0	.79	.65/1.1	.88	.55/1.0
YSPI: land	.62	.49/.48	.71	.55/.59	.37	.39/.37
CR: thinking skills						
Fluid	.19	.32/ − .02	.16	.22/ − .00	.27	.21/.38
Crystallized	.30	.24/.25	.32	.38/.49	.38	.20/.42
Practical	.05	.17/ − .08	.04	.02/.13	.05	.61/ − .13
CR: respect for elders						
Fluid	.10	.13/ − .03	.18	.29/.12	.08	− .01/.14
Crystallized	.01	.11/ − .28	.01	.16/ − .29	.02	.02/ − .12
Practical	.28	.13/.23	.24	.30/.07	.11	− .19/.30
CR: hunting skills						
Fluid	− .15	− .33/.05	− .19	− .26/.20		
Crystallized	− .11	− .10/.01	− .21	− .09/ − .05		
Practical	.48	.62/.17	.52	.65/.24		
CR: household skills						
Fluid	.19	.10/.38			.20	.12/.23
Crystallized	.07	− .09/.39			.07	− .04/.32
Practical	− .18	.04/ − .09			− .21	.05/ − .07

For Models 2, 4, and 6, the first column presents the estimates from the rural subsample, and the second column contains the estimates for the semiurban subsample.

the latent variables: .10 for fluid intelligence, .11 for crystallized intelligence, and .31 for practical intelligence. The correlations between the latent structures were as follows: fluid intelligence correlated with crystallized intelligence at .40 ($t = 2.6$), whereas practical intelligence correlated with fluid intelligence at .21 ($t = 1.6$) and with crystallized intelligence at .08 ($t = 0.7$). The parameter estimates for this model are shown in Table 4.

The second model for boys (Model 4) was similar to Model 3, but Model 4, just as for Model 2, included rural or semiurban subgroups. The fit statistics for this model (Model 4) were as follows: $\chi^2(74) = 76.3$ (P=.40), compared to the fit for the baseline model— $\div^2(104) = 292.7$ (P=.00); CFI was .988 and the SRMR was .111. Table 4 presents the parameter estimates for Model 6. The R^2 for the latent variables were (1) .19 for fluid intelligence, .17 for crystallized intelligence, and .49 for practical intelligence in the rural sample and (2) .02 for fluid intelligence, .21 for crystallized intelligence, and .06 for practical intelligence in the semiurban sample. The correlations between the latent structures were as follows: (1) fluid intelligence correlated with crystallized intelligence at .51 ($t = 2.9$), whereas practical intelligence correlated with fluid intelligence at .62 ($t = 3.1$) and with crystallized intelligence at .55 ($t = 3.0$) in the rural subsample and (2) fluid intelligence correlated with crystallized intelligence at .40 ($t = 1.6$), whereas practical intelligence correlated with fluid intelligence at − .01 ($t = -0.1$) and with crystallized intelligence at .14 ($t = 0.8$) in the semiurban subsample.

Here, once again, the difference between rural and semiurban samples' parameter estimates needs to be interpreted with caution due to the limited sample sizes and unavailability of standard errors for the estimates.

4.5.4. Girl-specific models

The first model for girls (Model 5) was similar to Model 1 above, only it did not include the ratings on hunting skills. This model provide an acceptable fit, although the fit was the worst of all surveyed models so far [$\chi^2(32)=46.6$, $P=.05$], compared to the fit for the baseline model [$\chi^2(52)=235.2$, $P=.00$]. The model's CFI was .920 and its SRMR was .065. The R^2 for the latent variables were .18 for fluid intelligence, .17 for crystallized intelligence, and .03 for practical intelligence. The correlations between the latent structures were as follows: fluid intelligence correlated with crystallized intelligence at .65 ($t=4.1$), whereas practical intelligence correlated with fluid intelligence at .27 ($t=1.9$) and with crystallized intelligence at .28 ($t=2.3$). The parameter estimates for this model are shown in Table 4. The second model for girls (Model 6) was similar to Model 5, but Model 6 took into account the community of origin (rural or semiurban) of the girls in the sample. The fit statistics for this model (Model 6) were as follows: $\chi^2(74)=82.7$ ($P=.22$), compared to the fit for the baseline model—$\chi^2(104)=300.7$ ($P=.00$); CFI was .956 and the SRMR was .097. Table 4 presents the parameter estimates for Model 6. The R^2 for the latent variables were (1) .07 for fluid intelligence, .04 for crystallized intelligence, and .35 for practical intelligence in the rural sample and (2) .29 for fluid intelligence, .39 for crystallized intelligence, and .11 for practical intelligence in the semiurban sample. The correlations between the latent structures were as follows: (1) fluid intelligence correlated with crystallized intelligence at .80 ($t=3.7$), whereas practical intelligence correlated with fluid intelligence at .53 ($t=2.0$) and with crystallized intelligence at .80 ($t=3.4$) in the rural subsample and (2) fluid intelligence correlated with crystallized intelligence at .36 ($t=1.6$), whereas practical intelligence correlated with fluid intelligence at .41 ($t=2.3$) and with crystallized intelligence at .57 ($t=2.9$) in the semiurban subsample. Once again, the difference between the patterns of correlations linking the latent variables is of interest (keeping the limitations of the sample sizes in mind). However, given that the zero-order correlations are not of this magnitude (but generally significant for rural and not significant for semiurban groups of adolescents), clearly, there is a need to replicate this effect before too much weight is put on it.

5. Discussion

We found that children in the semiurban community outperformed children in the rural community on the test of crystallized intelligence; children in the rural community, however, outperformed children in the urban community on the test of practical intelligence. We also found that a measure of practical intelligence assessing tacit knowledge provided prediction of rated practical skills that was complementary and, in certain instances, incremental to the prediction provided by conventional measures of fluid and crystallized intelligence. In the rural Yup'ik communities for which our test was created, the practical test was the best predictor of Yup'ik-valued traits, with R^2 values for practical-intelligence latent variable ranging from 35% (for girls only) to 53% (for the total sample). It provided lesser prediction in the semiurban community, as would be expected, given that members of the semiurban community engaged in the activities assessed by the YSPI far less than did members of the rural communities (the R^2 values for the latent variable of practical intelligence ranged from 5% in the combined sample to 11% in the girls' sample).

However, the model for the combined sample (boys and girls) amalgamating rural and semiurban groups of adolescents as well as the joint model for boys fitted as well as the multigroup rural/semiurban models. Two observations are important to note in the analyses of these models (Models 1 and 3). First, consistent with the discussion above, the models explained substantially more variance in the latent variable of practical intelligence than in either crystallized or fluid intelligence, indicating substantial predictive power of the measures of practical skills for the indicators of Yup'ik-valued traits. Second, whereas the correlations between the latent indicators of conventional abilities are high (.55 and. 40), the correlations between both fluid and crystallized intelligences and practical intelligence are low (.27 and .19 for Model 1 and .21 and .08 for Model 3). However, when these correlations are examined in the subsample of the rural adolescents, the pattern is different—the latent variable for practical intelligence tends to correlate significantly with indicators of fluid and crystallized intelligence. Although these findings are of interest, given that the observed correlations are significantly lower and the sample sizes are small, these connections should be explored further in the future research before their significance is fully understood.

In terms of theories of intelligence, our results suggest that tests of practical intelligence, in particular, as measured by tests of everyday domain-specific knowledge, can provide useful supplements to more conventional tests of more academic, analytical abilities (Neisser, 1976; Sternberg et al., 2000). Analytical and practical intelligence may show quite distinctive patterns of individual as well as developmental differences (Carraher et al., 1985; Ceci & Roazzi, 1994; Cornelius & Caspi, 1987; Denney & Palmer, 1981; Lave et al., 1984; Scribner, 1984; Sternberg, 1997). An ideal assessment of intelligence thus would measure practical as well as academic analytical skills. The former kind of measure, of course, supplements rather than replaces the latter. According to the triarchic theory, intelligence overall involves a blend of analytical and practical, as well as creative skills.

In terms of cultural settings, our results are largely consistent with the theories and data of Serpell (1976, 1993, 2000), Kearins (1981), and the Laboratory of Comparative Human Cognition (1982) in suggesting that members of different cultures may develop more skills that are adaptive in their own cultures and develop less skills that are adaptive in other cultures. Thus, it is possible to compare performances of members of different cultures only in a conditional way (Cole, 1996; Laboratory of Comparative Human Cognition, 1982), taking into account the kinds of behavior that are adaptive in a given cultural setting. And in making such comparisons, it is important to realize that what appears to be the same test may not be testing the same skills in different cultural settings (Greenfield, 1997).

One could argue, of course, that the kind of practical intelligence we measured did not truly reflect practical intelligence or even intelligence at all. But in terms of the kinds of knowledge and skills considered adaptive in the culture we have studied, we believe our measure was of intelligence in the sense in which the term most often has been used (Intelligence and its measurement, 1921; Sternberg & Detterman, 1986), namely, as a construct reflecting cultural adaptation. One could further argue that folk knowledge somehow should not "count." But it counts in the culture we studied and is the basis for everyday survival. And if intelligence is not about individual differences in everyday survival skills, what is it—or should it be—about?

Our study is characterized by a number of weaknesses. Specifically, our sample size is clearly not big enough to differentiate well the groups of interest (rural boys and girls and semiurban boys and girls). However, collecting data in Alaskan villages is a huge challenge, both in terms of the distances between the remotely situated villages and the weather conditions that often make these distances very challenging to traverse. To our knowledge, this study was one of the very few that collected performance data from a sample of this size comprising Yup'ik adolescents. Moreover, we were not always able to describe accurately the ethnic background of adolescents in the sample. Although we asked the question of ethnic identity, many teenagers preferred not to answer this question. For those adolescents who currently live in Dillingham, we had no information on the duration of their stay in town. Clearly, such detailed information would have been helpful in explaining the patterns of performance on YSPI among the adolescents in Alaskan villages and Dillingham. Moreover, it appears that, on all of the study indicators, the rural girls showed the lowest levels of performance. It is possible that our pattern of results is real and indicates the presence of "double disadvantage" for the rural girls. The double disadvantage would be that (a) they underperform on the academic measures as compared to the urban youth due to the rural–urban disadvantage and (b) they are underrated on indicators of Yup'ik values due to the male–female inequality observed in traditional societies. Another possibility is that our assessments were not successful in capturing the domains in which these girls excel. Finally, it would have been very helpful to develop even more domain-specific items tapping into various Yup'ik-specific activities (e.g., story knifing, knowledge of Yup'ik language), and we hope to do so in our future work.

Our results are largely consistent with a wide body of knowledge suggesting that measures of conventional IQ-like abilities tell a part, but not the whole story of a person's intelligence, broadly conceived. Our study may have some value as a stand-alone demonstration of the importance of practical intelligence. But the study also joins a growing body of knowledge suggesting that practical intelligence can be and often is largely distinct from academic intelligence.

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