Intelligence 47 (2014) 23–33

Contents lists available at ScienceDirect

Intelligence

Cognitive ability and epistemic rationality: A study in Nigeria and Germany

Heiner Rindermann *, Luisa Falkenhayn, Antonia E.E. Baumeister

Department of Psychology, Technische Universität Chemnitz, Germany

ARTICLE INFO

Article history:
Received 7 May 2014
Received in revised form 9 August 2014
Accepted 18 August 2014
Available online 26 September 2014

Keywords:
Ability
IQ
Rational thinking
Intercultural comparison
Africa

ABSTRACT

Based on a Piagetian cognitive epistemology approach, this study investigated cognitive ability levels and their relation to thinking patterns in Nigeria and Germany (N_{Ni} = 29–47 and N_{Ge} = 52–70). 12 selected items of the Raven's Advanced Progressive Matrices test (APM) and a self-designed questionnaire measuring epistemic rationality (e.g. dealing with health issues, traffic and nature) were administered. The sample was of above-average education. The APM scores were 89.13 for the Nigerian and 111.33 IQ points (Greenwich IQ) for the German subsample (d_{corr} = 1.48, d_{IQ} = 22; corrected for education the estimated country IQs would be IQ_{Ni} = 77 and IQ_{Ge} = 99). APM and epistemic rationality correlated r = .61 (attenuated: r_{tt} = .71; N = 81). The mean difference in rationality was d_{corr} = 1.85. Comparisons with other studies and everyday behavior suggest that the mean test differences reflect true differences in cognitive ability and epistemic rationality. Cross-country effects were larger than individual effects indicating a strong impact of macro-social factors (partialling out country, the intelligence–epistemic rationality correlation decreases from r = .61 to r_p = .27). Consequences for a Piagetian based epistemic rationality theory are discussed.

1. Introduction

According to Piagetian epistemology, successful cognitive development enables people to think and act in a more rational way (Piaget, 2001/1947). Children not only acquire easy-to-observe concepts like conservation of mass, weight, length and number, but their worldview also becomes more "disenchanted". Not only is knowledge adopted, but also cognition is transformed with consequences for attitudes and ethics. Concretely, this means that an animistic-magic worldview is replaced by a more mechanical, empirical and logical worldview (Hallpike, 1978; Oesterdiekhoff, 2012b; Piaget, 2001/1947).

Cognitive ability and its development are investigated in different research paradigms. The two theoretically most important paradigms are the psychometric IQ approach using intelligence tests and the Piagetian epistemology approach analyzing development by means of cognitive experiments. *Cognitive ability* (or cognitive competence) comprises intelligence (the ability to think), knowledge (the store and retrieval of true and relevant knowledge) and the intelligent use of this knowledge. A broader concept of "intelligence" also includes knowledge aspects ("crystallized intelligence"). According to theory and empirical research, cognitive ability enhances the individual's understanding of concepts and causal relationships; it increases insight, foresight, and rationality. A higher cognitive ability level also increases individuals' access to better environments and enables *individuals*, *institutions*, *societies*, and *cultures* to improve the quality of environment. Moreover, cognitive ability brings about distal consequences, such as greater health and wealth, a more democratic society, political and economic liberty, a more complex culture, and in the long run enhanced intelligence by backward effects of these environmental factors (e.g., Gottfredson, 1997; Hunt, 2011; Rindermann, 2012).

* Corresponding author at: Department of Psychology, Technische Universität Chemnitz, Wilhelm-Raabe-Str. 43, D-09107 Chemnitz, Germany. Tel.: +49 371 531 38715; fax: +49 371 531 838715.
E-mail address: heiner.rindermann@psychologie.tu-chemnitz.de (H. Rindermann).

http://dx.doi.org/10.1016/j.intell.2014.08.006
0160-2896/

Cross-cultural comparisons of cognitive ability have used a variety of measurement approaches: Psychometric IQ tests (Lynn & Vanhanen, 2012), student assessment tests (Rindermann, 2012, 2013), Piagetian experiments (Oesterdiekhoff, 2012b), cognitively sophisticated riddles (Luria, 1976/1974), or analyses of everyday life behavior (Hallpike, 1978). Independently from the applied measurement approach, these cross-cultural comparisons have illustrated large differences in average cognitive ability. Using comparable tests in different countries, the highest results were consistently found in East-Asia, followed by Western countries (North, West, and Central Europe, North America, Australia and New Zealand), Eastern Europe, Southern Europe, Latin America, Arabian and Muslim countries, and countries in sub-Saharan Africa.

Concerning Nigeria, Lynn and Vanhanen (2012, p. 26, 408 f.) reported an average IQ of 71, based on 10 psychometric IQ samples. Using student assessment samples, they reported an average student assessment score ($M = 500$, $SD = 100$) of SAS = 303. This corresponds to a so-called Greenwich IQ of 66 or 72 IQ points, depending on chosen transformation method. Own analyses (Rindermann, 2013) using Lynn and Vanhanen's psychometric IQ collection and collections of student assessment tests resulted in an average cognitive ability level of 76 IQ points (corrected for student age and school attendance rate). Such results for an African country seem to be rather low, but they do not deviate from a more general sub-Saharan average of around 71 to 78 IQ points (Lynn & Vanhanen, 2012; Rindermann, 2013; Wicherts, Dolan, & Maas, 2010). Even studies conducted in the most advanced African economy, namely, in South Africa, did not reach higher results (Lynn & Vanhanen, 2012, IQ: 72). Compared to other developing countries and regions in the world with similar general developmental levels, the results are lower (e.g., Costa Rica, IQ: 87, Rindermann, Stiegmaier, & Meisenberg, 2014; Vietnam, IQ: 99, Rindermann, Hoang, & Baumeister, 2013). Discussions on the causes of these comparatively low ability levels vacillate around test bias and test knowledge, culture and genes, health and education, poverty and modernization (Rindermann, 2013).

1.1. The Piagetian cognitive development approach and epistemic rationality

Piaget classified cognitive development into four stages (Piaget, 2001/1947; Piaget & Inhelder, 1969/1966). Whereas cross-cultural psychology backed up the assumption of cultural independence regarding the stages' sequence and cognitive attributes, it did *not* corroborate the cultural independence of the final stage achieved. Results indicate that the first (sensorimotor stage, age 0–2) and the second stage (preoperational stage, age 2–6) are reached by all healthy persons across all cultures. The development of the third (concrete-operational stage, age 7–11) and the fourth stage (formal-operational stage, from age 11/12 onward), however, demand certain environmental conditions (Oesterdiekhoff, 2012b). Piaget (1974, p. 309) assumed that "In particular it is quite possible […] that in numerous cultures adult thinking does not proceed beyond the level of concrete operations [stage 3], and does not reach that of propositional operations [stage 4]."

Basically, Piagetian tests measure abstract and logical thinking by the use of experiments that assign persons to a level of preoperational, concrete or formal operations. Psychometric intelligence tests do not explicitly target these operations, but they measure abstract and logical thinking as well. Not surprisingly, results of Raven Matrices (SPM) and Piagetian tasks correlate around $r = .60$ (Jensen, 1980, p. 674). On the one hand, Piagetian tasks are good indicators of general intelligence or *g* (Carroll, 1993, p. 244 f.; Humphreys, Rich, & Davey, 1985). On the other hand, psychometric IQ tests are usable as indicators of cognitive development.

For Piaget, *epistemic rationality* represents the highest stage of cognitive development leaving behind cognitive egocentrism and its corollary animistic-magical thinking.[1] At its highest stage (formal-operational), thinking distinguishes between mind and world, subject and object and theory and reality. In contrast, at a lower level, infantile world views are based on animistic and magical thinking. *Animistic* thinking means assuming that physical things and phenomena (e.g., the sun) have a soul, intentions and a will like humans have. In *magical* thinking the person believes that s/he can influence physical things and phenomena by means of causally unrelated "techniques" (e.g., sacrifices, prayers, and spiritual cleanings).[2]

In the preoperational stage human's thinking does not distinguish between ego and world. Basically, the ego projects its subjective processes into the outside world (Oesterdiekhoff, 2011, 2012a). One's own desire is not only perceived as a subjective request but also as being integrated in the world order. Consequently, events happening in the world are perceived as reactions to an individual's action. The world and its "agents" are modeled resembling human beings. For example, the moon does not move due to laws of nature but it moves due to its own will or due to the will of a human on earth. Physical things are seen and treated as animated and, thus, as if they were psychologically influenceable. Psychic versus physic phenomena are not differentiated. An example of that thinking stage would be to assume that the sun is shining warmly because it does not want humans to freeze.

A thinker at the preoperational stage does not change perspectives. Instead, he or she is encapsulated in his or her own point of view. Preoperational thinkers assume that others and "things" would think and feel just as they do. Thus, they do not distinguish between their own versus others' perspective. They believe that any event has a meaning beyond chance. They regard everything happening as being connected to a person. There is no contingency. Not only children in preschool-age, but also adults who have not progressed to more advanced

[1] "Represents" or "is the effect of" etc.: Piaget's contributions are hardly definite. If we can express it in a colloquial way: There are shelves of thick books full of ideas on development which themselves are meandering across thousands of pages, but there is no clear final concept. We follow the reconstruction of Piagetian ideas by other researchers, by Habermas (1984/1981), Hallpike (1978), LePan (1989) and Oesterdiekhoff (2012a, 2012b).

[2] Knowing and believing in magical measures are not positive indicators of intelligence, but negative ones. Of course, as all knowledge, knowing magic treatment stands for a functioning memory, but usually magical practices are ineffective treatments. An example is Sternberg et al. (2001) paper on intelligence in Kenya: The authors themselves rated knowledge on herbal treatment as a positive indicator, but there seems to be no positive effect (p. 406): "94% were infected with Schistosoma mansoni, 54% with hookworm, 31% with whipworm, and 19% with roundworm". Additionally, this ineffective knowledge correlated negatively with indicators of cognitive ability such as vocabulary of own language (Dholuo, $r = -.17$), English vocabulary ($r = -.32$) and Raven ($r = -.16$) (also see Gottfredson, 2003).