On the relationship of basic competencies and facets of intelligence

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Theoretical Background

The entry into working life is often connected with the question of the career entrance level of basic competencies in extra-functional areas. That means, besides functional qualifications or cognitive abilities, skills such as mathematical knowledge, computer literacy, spelling, foreign language skills, e.g., are expected by trainees and graduates.

Considering increasing globalization, the importance of foreign language proficiency, in particular knowledge of English, is getting more and more pronounced. In order to ensure communication in an international context, English proficiency has become indispensable in various occupational fields.

Since the predictive value of intelligence regarding academic success is well established, it is supposed that intelligence might be an underlying factor of foreign language proficiency. Research on this issue revealed contradictory evidence for language aptitude and intelligence as determinants of foreign language proficiency.

In different studies, the factors involved in foreign language proficiency have been found to be redundant (e.g. Oller, 1979), seperated (e.g. Boyle, 1987) or overlapping (e.g. Grigerenko, Sternberg & Ehrmann, 2000). These inconsistent findings might stem from the variety in the conceptualizion of intelligence. For instance, crystallized intelligence (g_c) is often assessed by tests of verbal ability, and therefore could be confounded by construct-irrelevant variance (Brocke, Liepmann & Beaducel, 2001).

The aim of the present study was to investigate the relationship between English proficiency and aspects of crystallized and fluid intelligence. It was examined in how far cognitive abilities that usually stem from socialization effects (crystallized intelligence), have a higher predictive value than aspects of fluid intelligence.

To assess English proficiency, a new instrument was developed as a part of an extensive test battery that measures basic competencies at career entrance. A multidimensional and hierarchical view of language aptitude (Carroll, 1972), consisting of listening, speaking, reading and writing, served as a theoretical framework for the test construction. Since the aim was to develop a test of English proficiency that can be easily administered in practice, the test was restricted to only one component, namely written English.

The intelligence facets were assessed by the IST 2000R. In addition, demographic characteristics as well as marks were obtained.

> **The purpose of the present study was to investigate the relationship between English proficiency and facets of intelligence as well as demographic characteristics and marks.**

Method

Participants

N = 220

Age:
• M = 20,57
• Range: 16 to 41 years

Gender:
• male = 48,2 %
• female = 49,1 %

Educational level:
• lower education: 25,5 %
• higher education: 50 %
• university: 20,9 %

Measure I: TfA / English

The TfA / English consists of 8 modules measuring translation, grammar, verbal, and spelling skills.

Translation:
Lied: a) air b) note c) song d) music

Grammar:
Dolly...in bed up to now.
a) am b) are c) is d) have e) has been

Verbal skills:
easy : hard = cheap: ?
a) favorable b) expensive c) never d) seldom e) often

Spelling (error finding)
He leaves the car in *frunt* of the church.

Cronbach's alpha, number of items, factor loadings, and communalities of the TfA and subdimensions

Scale	α	Items N	Factor loadings	h²
TfA English (overall score)	**.95**	**180**		
Translation	.78	40	.84	.70
Grammar	.93	60	.92	.83
Verbal skills	.83	40	.86	.73
Spelling	.78	20	.87	.74

N = 2135; α = Cronbach's alpha; h² = communalities
explained variance 75,8%
Eigenvalues: translation: 3,03; grammar: ,38; verbal skills: ,37; spelling: ,21

Measure II: IST 2000R

The basic module consists of 9 modules that discriminate between three content based abilities: verbal, numerical, and figural intelligence.

In addition, a knowledge test is applied, containing verbal, numerical, and figural questions from the fields of art-literature, geography-history, mathematics, science, daily life and economy.

	Reasoning	Knowledge
Verbal intelligence	Completing sentences: The opposite of hope is? (dispair)	Who invented the plane? (Brothers Wright)
Numerical intelligence	Calculations: 5^{4-1} (125)	In which year did the first world war start? (1914)
Figural intelligence	Matrices:	What is the name of the following figure? (ellipse)

Following Cattell (1963), additionally there will be a focus on crystallized and fluid intelligence.

IST 2000R: Factor loadings

Scale	α
Verbal intelligence	.88
Numerical intelligence	.95
Figural intelligence	.87
Reasoning	.96
Retentiveness	.93

N = 3484;
α = Cronbach's alpha

Results

Factor loadings of the overall English proficiency scale and the four subdimensions

Overall English proficiency
.84 — Translation
.92 — Grammar
.86 — Verbal skills
.87 — Spelling
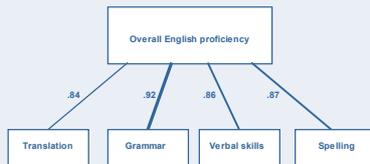
A principal components analysis revealed four factors loading on the TfA English proficiency overall score: Translation, Grammar, Verbal skills and Spelling. The factor loadings vary from .84 to .92.

Regression analysis to predict TfA English proficiency (overall score)

Model	variable	ß	R²
1	**TfA English (overall score)**		
	g_c	.23*	.40
2	Age	-.28*	
	Education	.45***	.53
3	Mark: English (FL)	-.47***	.71

*p < .05; ***p < .000;
g_c = crystallized intelligence, FL = Foreign language

Model 1: g_c
Model 2: g_c, age, education
Model 3: g_c, age, education, mark (English)

Stepwise multiple regression was conducted. Crystallized intelligence, age, educational level, marks in English entered the prediction equation at a significant level. These variables explain 71% of the variance in TfA English proficiency overall score.

Intelligence facets, personal characteristics, and their correlations with TfA English overall scores and subdimensions

	g_c	g_f	g	sex	age	edu	E
TfA English (overall score)	.56**	.34**	.37**	.21*	.39**	.51**	-.59**
Translation	.49**	.30**	.37**	.13	.46**	.37**	-.52**
Grammar	.48**	.27**	.37**	.19*	.24*	.49**	-.51**
Verbal skills	.56**	.41**	.39**	.19	.52**	.53**	-.54**
Spelling	.50**	.25**	.29**	.19	.28**	.44**	-.52**

g_c = crystallized intelligence, g_f = fluid intelligence, g = general intelligence, edu = educational level, E = English mark
* the correlation is significant (p < .05; 2-tailed)
** the correlation is significant (p < .01;2-tailed)

Among the intelligence facets, the highest correlation was found between the TfA English proficiency overall score and crystallized intelligence. Correlations between the TfA and fluid intelligence as well as general intelligence were significantly lower
⇒ a significance test revealed that the two correlations of .56 (TfA and g_c) and .34 (TfA and g_f) were significantly different from one another (t = 3,39, p < .001).

Discussion

The purpose of the present study was to examine the relationship between English proficiency assessed by the TfA and facets of intelligence. The most important finding is that crystallized intelligence is highest correlated with TfA English overall scores in comparison to fluid and general intelligence. This is in line with the view that both crystallized intelligence (Amthauer et. al, 2001) and foreign language proficiency stem from acculturation influences (Spolsky, 2000).

Since intelligence was assessed by an instrument that avoids contaminations of crystallized intelligence with verbal abilities, these findings are important in order to clarify the nature of relations between foreign language proficiency and intelligence.

In addition to crystallized intelligence, demographic variables such as age, and education, together with English marks, are found to be good predictors of English proficiency. The high predictive value of education is consistant with the view that English proficiency is guided by socialization influences.

As expected, English marks contribute most to TfA English proficiency, which provides evidence that the test is an appropriate measure of English proficiency.

Future research should investigate the role of additional variables, such as personality and motivational variables as predictors of English proficiency.

> **Findings of the present study indicate that crystallized intelligence is highest correlated with English proficiency, in comparison to fluid and general intelligence.**

Literature: Amthauer, R., Brocke, B. , Liepmann, D. & Beaducel, A. (2001). I-S-T 2000R Manual. Göttingen: Hogrefe
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