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The C-test: A valid instrument for screening language skills and reading comprehension of children with learning problems?

Markus Linnemann & Jürgen Wilbert*

Up to now, C-tests have neither been standardized nor designed for learning disabled students. Hence, we cannot justify C-tests being designed by teachers on their own account before their applicability to learning disabled students is not generally demonstrated. The goal of the study at hand is to determine the usability of C-tests within a population of learning disabled students. To attain this goal, we first adapted a version of the C-test for children with learning problems and afterwards compared the results of this measurement with those of the highly standardized and reliable "Knuspel" test. The results showed good test qualities and applicability of the C-test. Furthermore, the scores of the C-test correlated highly with the reading comprehension subscales of the "Knuspel" test.

1. Introduction

The goal of the present article is to make a contribution to the development of an instrument for the testing of language and reading comprehension skills of students with learning disabilities or severe learning problems. More precisely, we want to provide a fast, implementable, and easy-to-apply method for detecting language and reading comprehension skills of school children. Such an instrument would enable teachers to arrange a group of students with different skill levels into learning groups with homogeneous skill levels, to individualize their teaching or to apply other methods of horizontal differentiation.

The German educational system provides special education schools for children with learning problems. Students attending these schools are very heterogeneous with regard to the origins and kinds of learning problems. At least three subclasses may be distinguished: Firstly, there are students with mild mental retardation and borderline intelligence. These students have general problems with the acquisition of knowledge and with inferential processes, and they generally require more time for learning in comparison to other students of the same chronological age (cf. Grünke, 2004; Klauer & Lauth, 1997; Lauth, Brunstein &

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Grünke, 2004). These children may be called “learning-disabled”. Secondly, there are students with specific developmental disorders. These disorders refer both to scholastic skills like reading, writing, and computation (e.g., Lorenz, 2004) and to nonverbal, motor learning processes (cf. Myklebust, 1975; Rourke, 1991). We label these children “children with specific learning problems”. Thirdly, we find children from near-illiterate social classes with a highly vulnerable social background leading to severe motivational problems, a negative self-esteem and self-concept, an adverse attributional style with regard to achievement situations (e.g., Tominey, unpublished; Waheeda & Grainger, 2002), and a negative appraisal of education. We will call these children “socially disadvantaged”. This diversity of factors stresses the necessity for extended and intensive achievement diagnosis (e.g., number processing skills, basic reading and writing skills, language skills, and reading comprehension), as well as psychometric diagnostics (e.g., achievement goal orientation, self regulation, attribution style). Furthermore, from an educational perspective students with learning problems notably need individualized teaching methods and tasks well adjusted to their abilities.

Regrettably, these insights are rarely put into practice sufficiently. This may be caused by several reasons. Firstly, as teachers have to cope with many different tasks there is little time for long-winded standard tests. Secondly, most of the tests do not fit into a normal teaching context, i.e., they are difficult to integrate into a lesson and they explicitly constitute a test situation, which are likely to activate negative attitudes towards test situations and negative self-concepts, especially with students with learning problems. Finally, many teachers do not have the knowledge to correctly administer any of the standard tests. Hence, there is an urgent need for fast applicable, easy to exert, and implementable tests.

In the field of assessing language skills and reading comprehension, a variety of tests have been developed. But hardly any of them meets the just mentioned criteria and is at the same time suitable for testing children with learning problems. A promising exception is the C-test, at least for measuring language and reading comprehension skills.

C-tests are assumed to measure “general language proficiency”. But how exactly do we define “general language proficiency”? For the present study, “general language proficiency” is considered to include three of four separate competences described by Canale & Swain (1980). Our definition includes grammatical, discourse and strategic competences whereas pragmatic and sociolinguistic competences are left out. “Grammatical competence” is the knowledge and ability to use the lexical items, rules of phonology, morphology, syntax, and seman-

tics properly. “Discourse competence” is the ability to infer the context of a given text from the meaning of its smaller linguistic entities. “Strategic competence” refers to “the verbal and nonverbal communication strategies that may be called into action to compensate for breakdowns in communication due to performance variables or due to insufficient competence” (Canale & Swain, 1980, p. 30). “Sociolinguistic competence” is “the ability to use language appropriate to a given communicative context, taking into account the roles of the participants, the setting, and the purpose of the interaction” (Savignon, 1983, p. 309).

In Bachman’s model (1990) language competence is initially divided into two competences, which are labeled “Organizational” and “Pragmatic” competence. “Organizational competence” is further divided into “Grammatical Competence” and “Textual Competence”. Grammatical competence is similar to the concept of Canale and Swain, textual competence is similar to what they call discourse competence. The second main branch of Bachman’s model is labeled “Pragmatic Competence” with a subdivision into “Illocutionary” and “Sociolinguistic” competences. Illocutionary competence refers to a functional use of language i.e., expressing of ideas and emotions, teaching and learning, problem solving and creativity. Sociolinguistic competence refers to the appropriateness of an utterance in a specific context.

In our view C-tests measure grammatical, discourse and strategic competences, or, in terms of Bachman’s model, organizational competences though no illocutionary or pragmatic competences. Nevertheless, we believe that organizational competence is a necessary precondition for pragmatic and sociolinguistic competence.

How well do C-tests meet typical test requirements? Test quality criteria (i.e., objectivity, reliability, validity, standardization including norms, and usability) are essential to C-tests, as they are for other tests. Objectivity is usually no problem in C-test scoring as long as only the orthographically, grammatically, and semantically correct entries are scored. Difficulties arise when orthographically wrong words are counted as correct or if there are several correct alternative solutions for one gap resulting from an ambiguous sentence structure, leading to lesser values of interrater concordance. Experience with C-tests shows that measures of reliability are usually very high, even for tests that were not pretested and are applied for the first time (Grotjahn, 2002, p. 214). Nevertheless, Grotjahn warns against using C-tests in decision procedures without a pilot research on that particular test version (Grotjahn, 1992, p. 246). It can be shown, for instance, that newly designed C-tests are often too easy to solve (Raatz & Klein-Braley, 1994, p. 257). Moreover, much research has been carried out to

face the problem of C-test validity and to investigate the mental processes underlying C-test solving.

Up to now, C-tests have neither been designed nor standardized for learning disabled students. Hence, we cannot justify C-tests being designed by teachers on their own account before their applicability to learning disabled students is not generally demonstrated. The objective of the study at hand is to determine the usability of C-tests within a population of learning disabled students. To attain this goal, we first have to adapt a version of the C-test for the target group of children with learning problems and to compare the results of this measurement with those of a highly standardized and reliable test. The latter test should be valid for measuring language comprehension and reading skills. We decided to use the "Knuspel" test (Marx, 1998).

The Knuspel test is a highly standardized and elaborated reading test. It claims to measure both basic reading skills and reading comprehension. It is composed of four subtests, each measuring a separate subscale: firstly, listening comprehension, secondly, decoding ability (i.e., the ability to construct a phonemic representation of a grapheme), thirdly, recoding ability (i.e., the ability to recall a denotation of a phonemic representation), and fourthly, reading comprehension. In the first subtest, participants are verbally instructed to carry out tasks (e.g., draw the first three letters of ones surname into the correct space). In the second subtest, pairs of words are presented: a lexical word and a phonetically or graphemically similar artificial word. Participants have to decide, whether the artificial word and the existing word are homophones. In the third subtest, participants are presented with an artificial word and their task is to decide whether there exists a lexical word pronounced identically. The fourth subtest is built up very similar to the first one, except for the instructions that have to be read by the participants instead of being given orally by the test administrator. There are several ways to analyze participants' performance in the Knuspel test, which will be described later. In brief, we get information about phonological awareness, reading comprehension, general language skills and language related cognitive functions like awareness and memory span. The Knuspel has norms for 1st to 4th graders and mono- and bilingual students.

Our objective was to construct a reliable C-test for children with learning problems. Reliability values above .8 should be reasonably high. A C-test should be easy to administer and the testing time should not be longer than 30 minutes. The test was supposed to measure reading comprehension and general language skills. We therefore expected a substantial correlation between students' C-test achievement and the comprehension related subscales of the Knuspel test.

2. Method

Participants. We investigated a sample of 27 7th to 9th graders from four German schools for children with learning difficulties (16 male and 11 female), aged between 13 and 16 (M = 14.37; SD = 1.01). Due to sickness, two students took part only at the first session of the investigation. Furthermore, seven students did not complete subtest four of the Knuspel test. One student did not complete the C-test due to motivational problems.

Design and material. The students completed the Knuspel reading test and the C-test in two separate sessions within a one-week interval. The overall length of time was about 90 minutes for the Knuspel test and 25 minutes for the C-test. All students were individually tested.

We created a C-test consisting of five non-fictional, explicative, descriptive, and narrative texts. Each text had 20 gaps (see Table 1). Beginning with the second word of the second sentence, the second half of every second word was deleted. In the case of an odd number of letters, the larger part was erased. All gaps were indicated by continuous lines of constant length. The first and the last sentence as well as the heading were left unmutilated to provide a greater amount of contextual hints. Two texts were selected from a youth magazine and used in another study as well (FELIX and PIZZA, cf. Kniffka & Linnemann, forthcoming), two were selected from popular magazines (HANDYS and KATZE), and one was taken from a lexicon for children (STREIT). The texts were slightly altered, mainly shortened with context and coherence left intact. All texts were considered fitting the lifeworld and the intellectual possibilities of the target group. Native and fully literate speakers without learning disorders should obtain near-perfect scores. Table 1 shows the mean score of fully literate speakers, who all scored near-perfect as expected. A pre-test on the target-group could not be accomplished, so the texts were arranged by estimated difficulty. Each correct restoration scored one point, that is, the original word or an orthographically, grammatically and semantically correct variation. Orthographic mistakes were counted as mistakes. The final score was calculated by summing up the scores for each individual text.

The Knuspel reading test was left unaltered.

Table 1. Title, length, number of gaps, and difficulty of the texts used in the C-test.

Title of Text	Short title	Number of words	Number of gaps	mean score *(sd)* of fully literate speakers (n = 9)
Mobile Phones	HANDYS	66	20	19.9 *(.33)*
Our housecat descended from wild cats	KATZE	68	20	19.7 *(.71)*
Felix and his lucky pencil case	FELIX	86	20	20.0 *(.00)*
The quarrel	STREIT	63	20	19.7 *(.71)*
Pizza against PISA	PIZZA	82	20	19.3 *(.87)*
Complete test		365	100	98.6 *(1.24)*

3. Results

The results for the two tests used in our study will be described in more detail below. Subsequently, the interrelations between them will be analyzed.

3.1. Results of the C-test

At the beginning we were not sure whether the C-test was suitable for use with students with learning problems at all. We expected a few students to fail the C-test or even deny its processing altogether, but only one of the students did not complete the C-test due to motivational problems. This was by far less than we had expected. Test-taking time was limited to 25 minutes for the task, five minutes for each text. No extra time was given. Test administrators made sure the instructions were understood thoroughly before the task, which turned out to be easier than expected.

As common in C-test research, the items of the consistency analysis are not the gaps but the texts. The five texts of the C-test had a high internal consistency (Alpha-Cronbach = .84). The item-total correlations of the five tests were all above .58. The mean C-test score ranged from 13 to 71 (M = 36.1; SD = 16.0; see Table 2). Due to the lack of any test standardization we related the results to scores of competent speakers and to scores of students with migrational background (i.e., students learning German as L2). Participants of the study at hand scored more than 60 points lower regarding to the overall C-test score, compared to competent speakers. Regression analysis revealed that participants

tested here achieved results of students with migrational background learning German as L2 for approximately 1.1 years (mean scores of 8.3 for FELIX and 7.2 for PIZZA, see Table 2). Minimum and maximum parameters showed an acceptable range. Minimum scores of two texts (STREIT and PIZZA) were zero. Mean and standard deviation of all texts showed no floor effect, thus, complete mental overload indicated by absolute failure was no problem to most of the participants. Moreover, there was no ceiling effect.

During the process of test designing we had estimated the difficulty of the five texts to place them in ascending order. However, empirical data indicated a different order. Our C-test did start with the easiest text, though. Kolmogorov-Smirnov-test of normal distribution showed no significant deviation ($p > .93$). However, this result must be interpreted with caution due to the low number of participants ($n = 24$). Altogether we can assert a sufficient usability of the C-test within our examined subpopulation.

Table 2. Statistical variables for scores of the five texts and the complete C-test.

Text	***min***	***max***	***m***	***sd***
HANDYS (Mobile Phones)	2	18	10.0	4.7
KATZE (Housecat)	1	11	5.6	3.0
FELIX (Felix)	2	17	8.3	4.5
STREIT (Quarrel)	0	13	4.6	3.2
PIZZA (Pizza)	0	15	7.2	4.5
Complete test	13	71	36.1	16.0

3.2. Results of the Knuspel test

Like the C-test, the Knuspel reading test was accomplished without any problems. The Knuspel test consists of four subtests (see above). It provides norms for 1st to 4th graders (for monolingual and multilingual children). As can be seen from Table 3, participants scored very low in all four subtests. The pattern of achievement fits very well middle to end 2nd graders. The overall reliability is sufficiently high (Cronbach's $\alpha = .84$). But a closer look at the subscales reveals an unsatisfactory low value of the decoding subscale ($\alpha = .33$).

Table 3: Statistical variables of the Knuspel subtests and the discrepancy score

Knuspel Subtest	***n***	***min***	***max***	***M***	***sd***	**Cronbach's α**
Listening comprehension	27	16	32	25.4 (-1.95)	4.2	.73
Recoding	27	10	37	20.4 (-1.27)	4.8	.66
Decoding	27	18	29	23.1 (-.90)	3.4	.33
Reading comprehension	20	10	31	22.6 (-2.01)	6.2	.86
All four scales	20	70	110	91.5	12.4	.84
Discrepancy score	20	-3	20	3.6 (0.99)	5.0	

Note: Standardized *z*-scores are given in parentheses. The standardized values refer to values of 4th graders. That is, a *z*-value of -1 indicated an achievement one standard deviation below an average 4th grader.

Each item of the two comprehension subscales of the Knuspel test was constructed of two aspects. Participants were asked about a certain fact (e.g., the first two letters of their surname). This is called the knowledge aspect of the task. At the same time, participants were instructed to give their answer in a specific way (e.g., write the two letters down on a particular line). This is called the pragmatic aspect of the task. Both, the knowledge and the performance aspect could be analyzed separately. A relatively higher score in the knowledge aspect could be caused by problems to integrate the two given pieces of information (e.g., a child knows the first two letters of his surname but does not know how to write these letters onto a particular line) or, in the case of orally given instructions, working memory related problems. We compared the achievement of the individual's performance with regard to these two aspects to the average performance of 4th graders. Participants scored a significant lower *z*-value in the performance aspect compared to the knowledge aspect, but only in the listening comprehension subscale ($m_{performance}$ = -1.57; $m_{knowledge}$ = -.97; $t(26) = 2.19$; $p < .05$; $d = .51$). Analysis of the reading comprehension scale did not show a significant effect. These results point to considerable difficulties concerning a participant's working memory, in particular problems in keeping all necessary information long enough active to fulfill the complete task.

The Knuspel comprehension scales consist of parallelized items. Thus, listening and reading factors can be dissociated from comprehension on an individual level of analysis. This allows for computation of the Knuspel-discrepancy score, that is, the difference between reading and listening comprehension (cf. Table 3). A positive discrepancy score denotes higher listening comprehension ability compared to reading comprehension, a negative score denotes the opposite. Dur-

ing normal language development, listening and reading comprehension assimilate, leading to a discrepancy score of zero at the end of primary school. We had a fairly high discrepancy score (m = 3.6; sd = 5.0), below that of 2nd graders (m = 2.7; sd = 4.2). Z-values standardized for 4th graders showed an average of m = .99 (sd = 1.69). These results point to a developmental retardation.

3.3 Validity of the C-test

To what extend could individuals' achievement in the C-test be explained by performance in the Knuspel test and vice versa? To answer this question, we carried out a correlation and a linear regression analysis. All assumptions, including bivariate normal distribution of the variables and normal distribution of the residuals, were met. Collinearity (i.e., predictor variables are highly correlated) was not a problem here. Table 4 shows the correlations and standardized regression coefficients between C-test and Knuspel scores. There was a high correlation between the C-test scores and the overall Knuspel score. 69% (determination coefficient) respectively 72% (squared multiple correlation, R^2) of the C-test variance can be explained by the Knuspel overall score. A closer look at the subscales revealed no correlation with decoding and recoding competency, as expected. Furthermore, the correlation to the reading comprehension scale was very high (r = .83). But surprisingly, there was no significant correlation to the listening comprehension scores (r = .24). Also, we found a significant negative correlation between the C-test and the discrepancy score (r = -.60). That is, the more reading and listening comprehension approximate the higher the C-test score. With respect to the interpretation of the discrepancy score mentioned before, we may conclude a negative relation between developmental retardation and C-test achievement. That is, the lower the developmental retardation, the higher the C-test score.

Table 4. Correlations and standardized regression weights between the C-test and the Knuspel test.

Knuspel subtest	$r_{C\text{-}test\ /\ Knuspel}$	**standardized regression weights** ***(β-weights)***
Listening comprehension	.24 (24)	.17 (17)
Recoding	.08 (24)	.09 (17)
Decoding	.29 (24)	.25 (17)
Reading comprehension	.83** (17)	.64** (17)
All four scales (total score)	.83** (17)	
Discrepancy score	-.60* (17)	

Note: Sample size is given in parentheses. $R^2 = 0.724$

* $p < .05$. ** $p < .01$ (two tailed)

4. Discussion

We investigated the usability, reliability, and validity of a C-test for use with children with learning problems. As expected, participants of the present study scored very low in both tests. None of them achieved appropriate scores compared to their peer group and to competent speakers. Students tested here reached scores of L2-students learning German for 1.1 years, which is extremely low. We consider the main difference between children with learning problems and students just starting to acquire German as a second language to be the lack of pragmatic and sociolinguistic competences in the latter group, competences that the C-test does not measure. Further investigations have to be carried out and can be valuable for C-test validation.

Besides reading comprehension problems and reduced basic reading skills, we found evidence for developmental retardation, attentional problems, and working-memory impairment. Nevertheless, results reported here reveal good test performance criteria for the C-test. The test reliability indicated by the internal consistence is sufficiently high. The correlations between the C-test and the Knuspel test indicate that the C-test primarily measures reading comprehension. No correlation was found to basic reading skills. Interestingly, we found no correlation between the C-test and the listening comprehension. That means, general language skills indicated by the ability to understand linguistic instructions seem to be less reflected by the C-test score. This could be due to the fact that

participants tested here had difficulties to maintain and integrate verbally given instructions, as well as to focus attention on the instructor long enough. However, with regard to the validity of the C-test it seems that reading comprehension outranks general language skills, at least for students with learning problems. Altogether, the results reported here justify the application of a C-test with adolescent students with severe learning problems.

Furthermore, the C-test was easy to use. The instructor training for the C-test took 10 minutes, while it took two hours (with an additional practice session) for the Knuspel test. Also, the C-test was very easy and fast to analyze, whereas analysis of the Knuspel was much more complex. Surely, the Knuspel gives a much more differentiated picture of students' achievement in different areas of reading performance. Yet, there are interesting fields of application for the C-test in an educational context. One possibility may be assigning students into homogeneous learning groups. Another may be the formation of heterogeneous dyads for implementing a peer tutoring system. In these cases, the C-test is more economic and applicable than most other diagnostic methods and additionally, it turns out to be very robust.

Unfortunately, up to now there is little standardized C-test material, especially for use with adolescents with learning problems, but this may change in the future.

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Appendix

C-test texts

Handys

Immer mehr Kinder und Jugendliche besitzen heute ein eigenes Handy. Immer wicht**iger** wird e**s** für s**ie**, das rich**tige** Handy m**it** den aktu**ellen** Klingeltönen u**nd** den cool**sten** Logos z**u** haben. Da**bei** kann m**an** leicht verg**essen**, dass e**in** Handy en**orm/dlos/tsetzlich** viel Ge**ld** kostet. Vi**ele** Jugendliche ge**ben** sehr vi**el** Geld f**ür** ihr Ha**ndy** aus. Bevor man sich also ein Handy anschafft, sollte man sich vorher genau über alles informieren.

Unsere Hauskatze stammt von der Wildkatze ab

Über die Herkunft von Katzen gibt es viele Legenden. Sicher i**st** aber, da**ss** unsere Hauska**tze** von d**er** Wildkatze abst**ammt**, die e**s** noch b**is** heute i**n** Ägypten gi**bt**. Schon v**or** vielen tau**send** Jahren hie**lten** diese Kat**zen** die Getreidela**ger** der Ägy**pter** von Mäu**sen** und and**eren** gefräßigen Naget**ieren** frei. Z**um** Dank wur**den** sie von den Menschen geliebt und sogar als Gottheit verehrt. Schließlich verbreiteten sich die Katzen auch in andere Länder.

Felix und sein Glücks-Mäppchen

Das Mäppchen von Felix hat eine lange Geschichte, er hat es von seinen Eltern vor zwölf Jahren zur Einschulung geschenkt bekommen. Felix h**at** viele Di**nge** in sei**nem** Mäppchen, z**um** Beispiel Postk**arten** und Fo**tos**. Bis je**tzt** hat i**hm** das al**te** Mäppchen b**ei** Tests i**n** der Sch**ule**

immer Glü**ck** gebracht. Ein**mal** hatte e**r** es z**u** Hause verg**essen**, und gle**ich** eine schl**echte** Note gesch**rieben**. Die anderen in seiner Klasse gucken immer etwas merkwürdig, wenn Felix sein grünes "Kindermäppchen" mit den bunten Tieren darauf auspackt, doch Felix fällt gerne auf.

Der Streit

Streitsüchtige Menschen fangen bei jeder sich bietenden Gelegenheit Streit an. Sie suc**hen** regelrecht d**en** Streit. M**an** nennt ei**nen** solchen Mens**chen** auch Streitha**hn/mmel**. Streitereien so**ll** man schli**chten/cht** und ra**sch** beenden. B**ei** Meinungsverschie**denheiten** entbrennt o**ft** ein lebh**after** Meinungsstreit, wo**bei** jeder vers**ucht**, seine Mei**nung** durchzusetzen, d**en** Streit z**u** gewinnen. B**ei** solchen Streit**ereien/s** gewinnt keiner der Streithähne. Denk daran, wenn zwei sich streiten, freut sich der Dritte.

Pizza gegen PISA

Pizzabäcker Usman Ülkü hatte eine Idee, um das schlechte Abschneiden deutscher Schüler bei der PISA-Studie zukünftig zu verhindern. Er ma**cht** den Schü**lern** aus d**en** umliegenden Sch**ulen** ein Ang**ebot**. Wer ei**ne** Eins i**n** einer Klassenar**beit** schreibt, bek**ommt** eine gro**ße** Pizza z**um** halben Pr**eis**. Aber n**ur**, wenn d**ie** Arbeit gez**eigt** wird. Se**it** drei Mon**aten** läuft d**ie** Aktion. Bis**her** konnten schon 15 Schüler die Pizza bill**iger** kaufen! Ob Pizza ein wirksames Mittel ist, um die Leistungen der Schüler dauerhaft zu verbessern, wird sich zeigen!