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van Eemeren, F.H.; Kruiger, T.

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Student performance in identifying unexpressed premisses and argumentation schemes

Frans H. van Eemeren, Kees de Glopper, Rob Grootendorst and Ron Oostdam

1. Introduction

An adequate evaluation of argumentation starts from an analytic overview of the argumentative discourse. In such an overview, among other things, the unexpressed premisses and the relevant argumentation schemes are identified (van Eemeren and Grootendorst 1984, 1992). The extent to which ordinary language users are capable of carrying out such identifications can only be answered by the use of empirical research. Here, we report about our empirical investigations on the performances of students in Dutch secondary education.¹

2. Theoretical background

2.1 Unexpressed premisses

It is perfectly normal for argumentative discourse to contain implicit elements. Implicitness does not necessarily lead to serious problems of interpretation. In many cases, the identification of the implicit elements in an enthymeme is quite simple. For example, in "Amos is pig-headed, because he is a teacher", it is obvious that the unexpressed premiss is the major premiss, or warrant, "Teachers are pig-headed". In specific contexts, it is also possible that the unexpressed premiss consists of a minor premiss, or data.² If it is perfectly clear from his behaviour that Amos is the prototype of a teacher, then it is equally obvious that the premiss "Amos is a teacher" has been left unexpressed if somebody says "[Of course, I am sure that] Amos is pig-headed: teachers *are* pig-headed".

In some cases, there seem to be several possibilities, so that the correct identification of the unexpressed premiss causes more problems. Therefore, in

¹ For earlier reports, see Oostdam (1990, 1991), Oostdam and Eiting (1991), and Oostdam and Emmelot (1991). Although our research focusses specifically on argumentation, it is in many respects related to empirical studies on persuasion and on logical reasoning.

² The concepts of 'warrant' and 'data' are taken from Toulmin's procedural model of argumentation (1969). Unlike Toulmin, who declares it typical of the "warrant" that it is left unexpressed, we acknowledge that in many cases the warrant is explicit while other elements remain implicit (van Eemeren, Grootendorst and Kruiger 1987: 199-207).

the pragma-dialectical theory of argumentation analytical instruments have been developed for the methodical determination of the premiss that has been left unexpressed. In this connection, a distinction is made between a premiss representing the "logical minimum" and the "pragmatic optimum". The logical minimum consists of the *if...then...sentence* which results from taking the explicit premiss of the argument as antecedent and the conclusion as consequent. The combination of the explicit premiss, the logical minimum and the conclusion constitutes a valid *modus ponens*.

In "Amos is pig-headed, because he is a teacher", for example, the logical minimum is "If Amos is a teacher, then he is pig-headed". The only function of the logical minimum is to connect pieces of information which are already given. The pragmatic optimum is, as a rule, obtained by rephrasing the logical minimum in a more general and informative way: "Teachers are pig-headed". It goes without saying that the generalization should fit in well with the rest of the discourse and that the validity of the argument is to be maintained and no unwarranted commitments may be ascribed to the speaker. For these reasons (and for lack of other evidence), alternatives such as "Teachers are always pig-headed" or "All teachers who are called Amos are pig-headed" do not qualify as the pragmatic optimum in "Amos is pig-headed, because he is a teacher".

2.2 Argumentation schemes

In order to make their standpoints acceptable, arguers rely on *argumentation schemes*.³ An argumentation scheme suggests a specific relation between what is stated in a premiss and that which is stated in the standpoint.⁴ In pragma-dialectics, three main categories of conventionalized argumentation schemes are distinguished, each characterizing a different type of argumentation. If it is not clearly indicated in the discourse which type of argumentation we are dealing with, some interpretation is required to identify the argumentation scheme used to justify the standpoint.

The first argumentation scheme is used when the acceptability of a premiss is transferred to the standpoint by making it understood that there is a relation of *concomitance* between what is stated in the premiss and that which is stated

³ Cf. van Eemeren and Grootendorst (1992). The concept of an "argumentation scheme" has been used earlier by authors such as Windes and Hastings (1969) and Perelman and Olbrechts-Tyteca (1969). It does justice to the fact that in assessing the quality of an argumentation, it must not only be determined whether the underlying reasoning is logically valid and starts from acceptable premisses, but also whether the standpoint defended is indeed made acceptable by the premisses. Logicians tend to be concerned with formal implications rather than substantive inferences, concentrating on the transmission of truth rather than acceptance. A full assessment of the argumentation also requires a pragmatic analysis of the use of argumentation schemes.

⁴ When referring to the claim that is defended in an argumentation, pragma-dialectics uses the term *standpoint* instead of *conclusion*, restricting the use of the term *conclusion* to the result of the logical reasoning underlying the argumentation. The reasoning from the premisses to the conclusion is analysed at the logical level where the focus is on formal validity, the appropriateness of the argumentation schemes for defending the standpoint is analysed at the pragmatic level.

in the standpoint. In this type of argumentation, arguers try to convince their interlocutors by pointing out that something is *symptomatic* of something else. The argumentation is presented as if it describes an expression, a phenomenon, a sign, or some other kind of symptom, of what is stated in the standpoint. For example: "Daniel is an actor [and actors are essentially vain], so he is certainly vain".

The second argumentation scheme is used when arguers try to convince their audience by pointing out that something is *similar* to something else. In this type of argumentation the acceptability of the premisses is to be transferred to the standpoint by making it understood that there is a relation of *analogy* between what is stated in a premiss and that which is stated in the standpoint. The argumentation is presented as if there were a resemblance, an agreement, a likeness, a parallel, a correspondence, or some other kind of similarity, between what is stated in the premiss and that which is stated in the standpoint. For example: "The measure I would like to take is fair, because the case we had last year was also dealt with in this way [and the one case is similar to the other]".

With the third argumentation scheme arguers try to convince their audience by pointing out that something is *instrumental* to something else. In this type of argumentation the acceptability of the premisses is to be transferred to the standpoint by making it understood that there is a relation of *causality* between a premiss and the standpoint. The argumentation is presented as if that which is stated in the argumentation is a means to, a way of, an instrument for, or some other kind of causative factor for, the standpoint, or *vice versa*. For example: "As Tom has been drinking an excessive amount of whiskey [and drinking too much alcohol leads to a terrible headache], he must have a terrible headache".⁵

3. Hypotheses

In our empirical research we concentrated on the students' skills in correctly identifying unexpressed major premisses versus unexpressed minor premisses and in the correct identification of symptomatic, analogy and causal argumentation schemes.

As explained by Grice and other theoreticians of communication, something that is considered to be obvious to the addressee is in ordinary discourse, in principle, left implicit. In argumentation with one explicit premiss, the major premiss which makes a transitional connection between the explicit premiss and the standpoint is often implicit. Unless the context requires otherwise, the

⁵ There are many subcategories of argumentation schemes. Among the symptomatic argumentations are presenting something as an inherent quality or as a characteristic part of something more general. Analogy argumentation includes making a comparison, giving an example and referring to a model. Among the causal argumentations are pointing to the consequences of a course of action, presenting something as a means to a certain end, and emphasizing the nobility of a goal in order to justify the means.

arguer assumes the major premiss to be understood and mentions only the minor premiss. Therefore, if no contradictory contextual information is provided, the most likely unexpressed premiss is the major premiss, and ordinary language users are aware of this. This leads to the following hypothesis:

- (1) In a context where no special information is provided, unexpressed major premisses are more often correctly identified than unexpressed minor premisses.

As soon as one statement is interpreted as an attempt to justify another, implicitly some kind of argumentation scheme is attributed to the argumentation. There is some psychological evidence that relations between propositions tend to be primarily perceived as causal.⁶ It is therefore not only to be expected that causal argumentation will be more often correctly identified than other types of argumentation, but also that non-causal argumentation will often—and all too soon—be regarded as causal. Since symptomatic argumentation is closer to causal argumentation than analogy argumentation, and often less clearly marked, this tendency is more likely with symptomatic argumentation than with analogy argumentation. However, analogy argumentation with a strongly temporal aspect may also easily acquire a causal interpretation. This leads to the following hypothesis:

- (2) Causal argumentation is more often correctly identified than analogy argumentation or symptomatic argumentation, and symptomatic argumentation is less often correctly identified than analogy argumentation.

As yet, we have no precise information as to the extent to which students differ in their skills in identifying unexpressed premisses and argumentation schemes. We have recent evidence however, that there are considerable differences in student achievements in the closely related domain of identifying standpoints and explicit premisses.⁷ Moreover, empirical research has, time and again, revealed strong individual differences in achievement in broad domains of cognitive skill, such as reading and writing.⁸ We therefore venture to hypothesize the existence of substantial individual differences in identifying unexpressed premisses and argumentation schemes:

⁶ See Nisbett and Ross (1980), who discuss not only causal relations, and Rayner and Pollatsek (1989, Ch. 8). A natural explanation for the tendency towards a causal interpretation is familiarity.

⁷ See van Eemeren, Grootendorst and Meuffels (1989).

⁸ See, e.g., Thorndike (1973), Applebee, Langer and Mullis (1986), and Elley (1992).

- (3) Individual differences in identifying unexpressed premisses and argumentation schemes will be substantial: the variance of *true* test scores will be larger than zero.

Individual differences in successfully identifying unexpressed premisses and argumentation schemes may have various causes. Generally, such differences in argumentation skills are expected to correlate with differences in general cognitive capabilities and achievement of students. In Dutch secondary education students are referred to different streams on the basis of their general cognitive skills.⁹ We therefore hypothesize a substantial correlation between students' school type and their argumentation skills:

- (4) Individual differences in identifying unexpressed premisses and argumentation schemes will be to a substantial degree correlated with schooltype: the medium effect sizes will be at least ($r > .30$).¹⁰

4. Design

4.1. Test format

Two paper-and-pencil tests have been constructed in order to test students' skills in identifying unexpressed premisses and argumentation schemes. Every test contains a series of multiple choice items which can be objectively scored. The assumption is that the fewer mistakes students make the greater command they have of a specific skill.

Test items have been constructed by means of a facet design.¹¹ In this design, the facets define cells or structures, each of which represents a certain form of appearance of an argumentative statement. The use of a facet design optimizes the content validity of a test and makes it possible to examine the effect of the facets systematically. In constructing the items, factors that might influence the identification (e.g. indicators for the standpoint) have been varied among the tests (i.e. the facets). Also, factors that might interfere with the facets were kept under control.

The items in both tests contain single sentences with two co-ordinated clauses (e.g. "Julian is an actor, so he is vain"). There is little variation in the length of the sentences. The style and level of abstraction are such that students can readily understand the sentence meaning. In order to prevent sequence

⁹ The Dutch system of secondary education (from grade 7 until grade 12) is highly streamed. After completing a transition class in grade 7, students are referred to one of the four streams (from low to high: junior vocational, lower general, higher general and academic secondary education) according to their cognitive capabilities and achievement (see Oostdam & Emmelot 1991).

¹⁰ Cf. Cohen (1969).

¹¹ Cf. Borg (1979) and Mellenbergh, Kelderman, Stijlen and Zondag (1979).

effects, the presentation of the items has been randomized.

The test instruction had to be read by the students without any interference from the teacher. The concepts of "unexpressed premisses" and "argumentation schemes" were defined with the help of examples. Furthermore, some examples of items were presented to demonstrate the test task. It was emphasized that there was no time-limit.

4.2. Identifying unexpressed premisses (Test 1)

The test concerning the skill of students in identifying unexpressed premisses contains eighteen multiple-choice items with single argumentation (a standpoint supported by one premiss). For the construction of test items various categories of enthymeme were distinguished (see Table 1).

Table 1: Categories of enthymeme

	referent standpoint is referent premiss	referent standpoint is not referent premiss
predicate standpoint is predicate premiss	(1) This is my bike, because it is mine. (circular reasoning)	(2) She must be a Catholic, because her parents are Catholics too. (unexpressed minor)
predicate standpoint is not predicate premiss	(3) John is English, therefore he is brave. (unexpressed major)	(4) I have to walk, because Yvonne has taken the car. (unexpressed non syllogistic premiss)

The first category includes fallacies of circular reasoning that do not have an unexpressed premiss. In the other three categories the character of the unexpressed premisses depends on whether the referent of the standpoint is or is not identical with the referent of the premiss, and whether the predicate of the standpoint is or is not identical with the predicate of the premiss. For each of the three categories of enthymemes six items were constructed: three items in which the standpoint precedes the premiss and three items in which the standpoint follows the premiss. As a consequence, the facet design contains six structuples (see Table 2).

Table 2: Facet design identifying unexpressed premisses (6 structuples, 3 items per structuple, a= premiss following standpoint, b= premiss preceding standpoint)

	minor premiss	major premiss	non-syllogistic premiss
position premiss	a b	a b	a b

Each multiple-choice item has four alternatives: the correct answer and three distractors constructed according to a preconceived construction plan: (1) a conversion of the right alternative, (2) a limited or blown-up variation of the

right alternative, and (3) a paraphrase of the converted/limited/blown-up right alternative or a stereotype that fits in with the context. The following item is an example of a structuple with an unexpressed major premiss and the premiss following the standpoint ("A" is the right alternative, "B" the conversion, "C" the limited version and "D" a stereotype):

He is a bad singer, because he cannot keep time.

- A. One who cannot keep time is a bad singer.
- B. Bad singers cannot keep time.
- C. Singers sometimes cannot keep time.
- D. One who cannot sing, is also unable to keep time.

The test is designed to measure students' skill in identifying unexpressed premisses. The test should be reliable: the test scores should provide precise and stable estimates of individual skill levels. The test should also be unidimensional: the scores should represent only the intended skill dimension; other systematic sources of individual differences should not be measured.

The test reliability was satisfactory (Cronbach alpha=.65). The test appears to measure a single performance dimension. Factor analysis according to the Fabin 2 method reveals that the data closely correspond to a one factor model.¹² The goodness of fit of a one factor model (gfi=.96) is hardly improved by the introduction of a second factor (gfi=.97)¹³.

4.3. Identifying argumentation schemes (Test 2)

The test of students' skill in identifying argumentation schemes contains twenty-four items with single argumentation, equally distributed over three categories: symptomatic, causal and analogy. Only the position of the premiss (preceding or following the standpoint) is manipulated. Therefore, the facet design has six structuples, each filled with four items (see Table 2). This is an example of a structuple with the argumentation scheme of analogy in which the premiss precedes the standpoint:

I do not have to be present at each birthday in your family, because your brothers in law do not come to each birthday either.

- Which argumentation scheme is employed?*
- ☐ symptomatic
 - ☐ causal
 - ☐ analogy
 - ☐ do not know

The reliability of the test was good (Cronbach alpha=.82). The test appears to

¹² Cf. Hagglund (1982).

¹³ Correspondingly the Fabin reliability for the one factor model is .65; the Fabin reliability for the two factor model is .66.

measure a single performance dimension. Factor analysis according to the Fabin 2 method yields a good fit of the one factor model ($gfi = .98$). The introduction of a second factor gives no meaningful improvement of the model fit ($gfi = .99$)¹⁴

4.4. Subjects

The tests were administered within the context of a national assessment in the pre-final grades of secondary education.¹⁵ Representative samples of students were tested: grade 9 students in the junior vocational (J-VOC) and lower general (LO-GEN) streams, grade 10 students in the higher general stream (HI-GEN), and grade 11 students in the academic stream (ACA). For the purpose of this study additional samples of grade 9 students from the higher general and the academic stream were tested, thus allowing for a unbiased test of hypothesis 4.¹⁶ Hypotheses 1, 2 and 3 are tested on the data of the main sample.

Table 3: Sample size (N of schools, N of students for Test 1 and 2), modal student age and intra-class correlation for main sample

Sample	School Type	Grade	Modal Age	N Schools	N Students	
					Test1	Test2
main	J-VOC	9	15	34	310	293
main	LO-GEN	9	15	27	398	390
main	HI-GEN	10	16	39	461	456
main	ACA	11	17	32	338	338
additional	HI-GEN	9	15	9	117	107
additional	ACA	9	15	7	89	81

Three-stage random samples were drawn: within each sampled school, one classroom was sampled and within each classroom the tests were administered to a sample of at least 10 students.

¹⁴ Correspondingly the Fabin reliability for the one factor model is .82; the Fabin reliability for the two factor model is .82.

¹⁵ Cf. Oostdam (1991).

¹⁶ Hypothesis 4 will be tested on the four strata of grade 9 students only, thus excluding age differences as a source of variation.

5. Results

5.1. Identifying unexpressed premisses

Hypothesis 1 was tested by means of analysis of variance. The proportion of correct responses for the four strata of the main sample was calculated for each item. The resulting item level data ($n=72$, i.e. 18 items x 4 groups) were input to an analysis of variance with the type of unexpressed premiss, position of the premiss and school type as fixed factors (see Table 4).

Table 4: Analysis of variance with the type of premiss, position of premiss and school type as fixed factors ($n=72$).

Source of Variation	SS	df	MS	F	p
Type of Premiss	0.508	2	0.254	16.214	.000
Position of Premiss	0.011	1	0.011	0.729	.397
School type	0.649	3	0.216	13.803	.000
Type x Position	0.280	2	0.140	8.938	.001
Type x School	0.020	6	0.003	0.213	.971
Position x School	0.001	3	0.000	0.016	.997
Type x Position x School	0.010	6	0.002	0.106	.995
Explained	1.479	23	0.064	4.104	.000
Residual	0.752	48	0.016		
Total	2.230	71	0.031		

Table 5: Proportion correct responses (pc) per type of premiss and position of premiss

Factors	pc
Type of premiss	
minor premiss	.46
major premiss	.62
non-syllogistic premiss	.65
Position of premiss	
preceding the standpoint	.56
following the standpoint	.59
Type x Position of premiss	
minor premiss preceding standpoint	.48
major premiss following standpoint	.44
minor premiss preceding standpoint	.66
major premiss following standpoint	.58
non-syllogistic premiss preceding standpoint	.55
non-syllogistic premiss preceding standpoint	.75

The proportion of correct responses is clearly affected by the type of premiss ($F=16.214$). The effect of the type of premiss is strong; the factor explains 23% of the total variance at the item level.¹⁷ As predicted, argumentation with an unexpressed non-sylogistic or major premiss is more often correctly identified than argumentation with an unexpressed minor premiss (see Table 5). According to the Scheffé test in a one-way analysis of variance with type of premiss as a fixed factor this contrast is significant at the .05 level.

There is no significant main effect of the position of the premiss. The main effect of the school type is considerable ($F=13.803$, 29% explained variance). There is a substantial interaction ($F=8.94$, 13% explained variance) between the position of the premiss and the type of premiss that is not expressed. Argumentation with an unexpressed minor premiss or an unexpressed major premiss is more correctly identified when the premiss follows the standpoint. The reverse holds for argumentation with an unexpressed non-sylogistic premiss (see Table 5).

5.2. Identifying argumentation schemes

In order to test hypothesis 2, an analysis of variance on the proportions correct responses for the four strata of the main sample for each of the 24 items of test 2 was carried out. The item level data ($n=96$, i.e. 24 items x 4 groups) were input to an analysis of variance with type of argumentation scheme, position of the premiss and school type as fixed factors (see Table 6).

The proportion correct responses is clearly affected by the type of argumentation scheme ($F=24.608$). The effect of the type of scheme is strong; the factor explains 26% of the variance at the item level. Contrary to our expectation, the causal scheme and the analogy scheme are identified with equal correctness. The causal scheme and the analogy scheme are identified more correctly than the symptomatic scheme (see Table 7). According to the Scheffé test in a one-way analysis of variance with type of argumentation scheme as a fixed factor this contrast is significant at the .05 level.

There is a significant main effect of the position of the premiss ($F=6.881$, 4% explained variance). When the premiss follows the standpoint, argumentation is more correctly identified. School type has again a considerable main effect ($F=16.205$, 26% explained variance). As in test 1, there is an interaction ($F=4.638$, 5% explained variance) between the position of the premiss and the type of argumentation scheme. For the causal scheme the sequence premiss-standpoint is slightly easier.

¹⁷ The ratio of the SS for a given source of variation to the total SS is used as an index of the proportion of variance accounted for.

Table 6: Analysis of variance with the type of argumentation scheme, position of the premiss and the school type as fixed factors ($n=96$).

Source of Variation	SS	df	MS	F	p
Type of Argumentation Scheme	0.504	2	0.252	24.608	.000
Position of Premiss	0.070	1	0.070	6.881	.011
School type	0.498	3	0.166	16.205	.000
Type x Position	0.095	2	0.048	4.638	.013
Type x School	0.006	6	0.001	0.096	.997
Position x School	0.001	3	0.000	0.028	.994
Type x Position x School	0.001	6	0.000	0.021	1.000
Explained	1.176	23	0.051	4.990	.000
Residual	0.738	72	0.010		
Total	1.913	95	0.020		

Table 7: Proportion correct responses (pc) per type of argumentation scheme and the position of the premiss

Factors	pc
Type of argumentation scheme	
analogy scheme	.84
causal scheme	.85
symptomatic scheme	.69
Position of premiss	
preceding the standpoint	.77
following the standpoint	.82
Type of argumentation scheme x Position of premiss	
analogy scheme, premiss-standpoint	.88
analogy scheme, standpoint-premiss	.80
causal scheme, premiss-standpoint	.84
causal scheme, standpoint-premiss	.87
symptomatic scheme, premiss-standpoint	.75
symptomatic scheme, standpoint-premiss	.64

Incidentally, the distribution across response alternatives differs between item types. The symptomatic scheme is very often identified as a causal scheme:

two-thirds of the misidentifications pertain to this alternative. For the scheme of analogy there is a similar, though less marked, tendency. In case of the causal scheme, errors are distributed equally across distractor types (see Table 8).

Table 8: Identifying argumentation schemes: distribution across response alternatives (percentages)

Item clusters	%
Analogy scheme:	
1. symptomatic	4.4
2. causal	8.1
3. analogy	85.2
4. do not know	2.4
Causal scheme:	
1. symptomatic	4.8
2. causal	86.7
3. analogy	5.2
4. do not know	3.3
Symptomatic scheme:	
1. symptomatic	70.5
2. causal	20.0
3. analogy	7.3
4. do not know	3.2

As regards the analogy scheme and the causal scheme, the distribution across response alternatives is highly similar for the different student groups in the main sample. As regards the symptomatic scheme, the relative frequency of students interpreting the symptomatic scheme as a scheme of analogy decreases from group 1 to group 4.

5.3 Individual differences

A test of hypothesis 3 was performed through computing standard errors of measurement for individual test scores. For each of the strata from the main sample means, standard deviations and standard errors of measurement were calculated. From Table 9 it is clear that individual differences are substantial in all student groups. In identifying unexpressed premisses, grade 9 vocational students (J-VOC), for example, on average identify between 8 and 9 out of 18 items correctly. The standard deviation in this group is as large as 3 points. The standard error of measurement for individual scores is 1.81 in size. This indicates that observed scores which differ 7 score points indicate true individual differences with a certainty of 95%.¹⁸ In other groups the difference in iden-

¹⁸ The 95% confidence interval for a true score is constructed as the observed score plus or minus the product of the standard error of measurement and the z-value corresponding to the 95% confidence level (i.e. 1.96).

tifying unexpressed premisses are of a similar size. The test for the identification of argumentation schemes shows individual differences of a very similar size.¹⁹

Table 9: Size of individual differences in identifying unexpressed premisses and argumentation schemes: mean scores, standard deviations and standard errors of measurement

	Main Sample			
	J-VOC	LO-GEN	HI-GEN	ACA
<i>Unexpressed premisses</i>				
Mean	8.45	9.04	11.08	12.80
Standard deviation	3.06	2.97	2.74	2.34
Standard error	1.81	1.75	1.62	1.38
<i>Argumentation schemes</i>				
Mean	17.05	17.87	20.45	21.15
Standard deviation	4.48	4.39	3.24	2.79
Standard error	1.88	1.84	1.36	1.17

5.4 Individual differences and schooltype

Hypothesis 4 was tested on the grade 9 strata of the sample only. The correlation between students' school type and their argumentation skills was computed in the following manner. For each of the four strata a dummy variable was constructed, indicating for each individual student strata membership. The multiple correlation of the four dummy variables and the total scores on the test of identifying unexpressed premisses is .46 ($p = .000$); on the test of identifying argumentation schemes the correlation is .40 ($p = .000$).

As expected, the correlation between schooltype and argumentation skills is substantial. In terms of effect sizes, the effect of school type is between medium and large for both tests.²⁰ The differences in general cognitive capabilities and achievement of students that underly the school type differences appear to be associated with specific argumentation skills.

A comparison of the results of the additional sample with the main sample reveals that differences between school types clearly outweigh differences between grades within school types. There is relatively little increase in scores

¹⁹ A comparison between tests has to take into account that the tests contain a different number of items: 18 in test 1 and 24 in test 2.

²⁰ Cf. Cohen (1969).

within the higher general and the academic stream.²¹ The per grade increase in number of items correct varies between 0.18 and 0.50. The within-grade differences between school types amount to 3.42 and 3.75 score points.

6. Discussion

The results of the test regarding the identification of unexpressed premisses clearly confirm the hypothesis that in a context where no special information is provided unexpressed major premisses are more easily identified than other unexpressed premisses. Students have more difficulty in identifying unexpressed minor premisses than in the identification of unexpressed major premisses and non-syllogistic premisses.

In case of an unexpressed major (or a non-syllogistic) premiss, as in "Amos is pig-headed, because he is a teacher", the unexpressed premiss - "teachers are pig-headed" - is rather obvious, even without any specific contextual information. Such a warrant-like or major premiss constitutes the transitional connection between the explicit minor premiss and the standpoint. When the question of identifying unexpressed minor-premisses is at stake, the situation is just the opposite. The referents in standpoint and premiss are then not identical. This causes problems in identifying the minor premiss and this explains the tendency of marking an incorrect/false premiss.

The test results also confirm the hypothesis that causal argumentation is more easily identified than analogy argumentation or symptomatic argumentation. The causal argumentation scheme is most easily identified. Unclear symptomatic argumentation and unclear analogy argumentation often lead to a causal interpretation of the relation between the two propositions by the students. As was predicted, this tendency to opt for a causal interpretation is stronger in the case of symptomatic argumentation than in the case of analogy argumentation.

In accordance with the third hypothesis, sizeable individual differences have been found in the identification of unexpressed premisses and the identification of argumentation schemes. This result corresponds with previous findings from empirical research into individual differences in cognitive skills. Individual differences are correlated with schooltype to a substantial degree. This result confirms hypothesis four and indicates that the individual differences in the two specific argumentation skills under study are related to differences in more general cognitive capabilities.

Interestingly, within-grade differences between school types outweigh between-grade differences within school types. In the Dutch secondary education system, according to their general cognitive skills and achievement, students are following different programs (vocational to academic). The between-school dif-

²¹ Means and standard deviations () for identifying unexpressed premisses for grade 9 students from the higher general and academic stream are respectively 10.79 (2.90) and 11.87 (2.53). For identifying argumentation schemes the corresponding values are 19.95 (2.96) and 20.80 (2.90). For the higher general stream the comparison between main and additional sample involves a one-grade difference; for the academic stream the difference involves two grades.

ferences in argumentation skills reflect these underlying general cognitive differences.

The lack of progress per grade should be interpreted in the light of the absence of any real attention to argumentation instruction in Dutch secondary education. There is, in fact, little or no direct instruction in argumentation. Students read and write argumentative texts without much instruction; they learn about argumentation by practicing it. We are convinced that more explicit teaching of argumentation will foster the development of argumentation skills.