Argument form and cognitive components

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1. Introduction

Results from empirical research have time and again revealed individual differ-ences in achievement in broad domains of cognitive skill, such as reading and writing. Furthermore it is well known that reading and writing are not unidimensional competencies. Both draw upon a heterogeneous complex of knowl-edge and skills. Some students are especially skilled in formulating while others are outstanding in text organization.

According to an assessment study into argumentation skills, students also differ in their skills in identifying, analysing and evaluating argumentation (cf. Oostdam 1990; Oostdam & Eiting 1991; van Eemeren, de Glopper, Grootendorst & Oostdam 1994). Analogue to these differences in receptive skills, we found that students vary considerably in their skills in producing arguments as well (cf. Oostdam, de Glopper & Eiting 1994). It becomes evident that argumentation skills are as manyfold as reading and writing. In arguing, language users draw upon numerous sources of knowledge and skill. Strong correlations were found between tests that measure similar skills such as identifying and analysing points of view and arguments, while much lower correlations occur between tests that measure more distinct skills such as evaluating indirect argumentation, unexpressed premises and argumentation schemes.

In this article we discuss four tests which measure students' skill in identifying and analysing points of view and arguments. We will address the question whether all items measure one single underlying skill or whether different types of items measure different cognitive skills or components.

2. Method

In the context of a study into argumentation skills of Dutch students in grades nine through eleven pencil-and-paper tests have been constructed for the measurement of receptive argumentation skills. Test construction was guided by the pragma-dialectical theory of argumentation (cf. van Eemeren & Grootendorst 1984).

The tests measure receptive argumentation skills such as analysing points of view and arguments in single, multiple, coordinate and subordinate argumentation, analysing indirect argumentation and unexpressed premisses and evalua-ting employed argumentation schemes and argument validity. Within the framework of this article we confine ourselves to four tests which have been developed for measuring students' skill in analysing points of view in simple single and simple

multiple disputes and in analysing arguments in single and multiple argumentation (see van Eemeren & Grootendorst 1984).

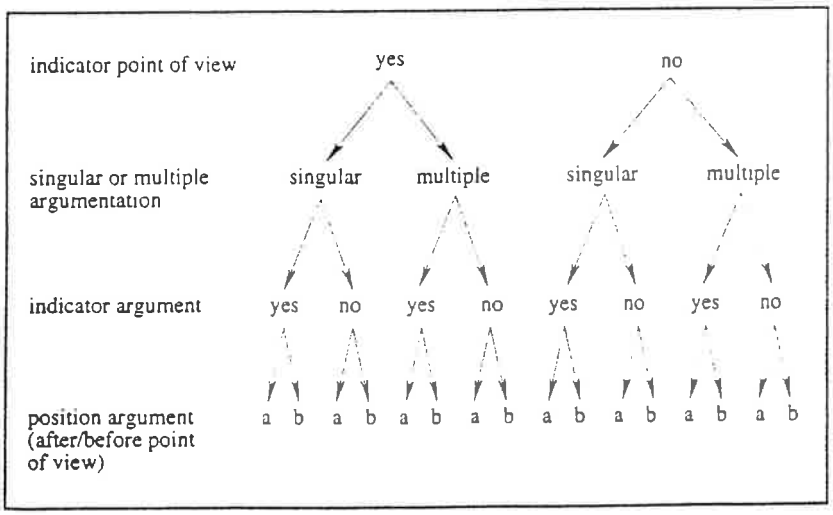
For each test a set of argumentative and non-argumentative items has been constructed. The non-argumentative items function as distractors. Construction of the argumentative items took place by means of a facet-design. The facets define specific forms of appearance of an argumentative statement. A selection has been made of facets which may be of influence on identifying points of view based on theoretical and previous empirical research (cf. Oostdam 1991). For all four tests the following facets have been selected: 1) the presence of argument indicators ("thus", "so", "because"), 2) the presence of point of view indicators ("in my opinion", "according to me"), 3) the position of the argument (before or after the point of view) and 4) the presence of single or multiple arguments sustaining the point of view.

A survey of the facets per test will be given below, followed by a schematic reproduction of various structuples from the facet design. Model items will be included as illustration.

Test 1: analysing points of view in single disputes

The facet-design for the test directed to analysing points of view in single disputes contains 16 structuples that have each been defined by a combination of facets (see diagram 1). The complete test contains 30 items: 16 argumentative items and 14 non-argumentative items. Per item students had to answer a multiple choice and an underline question: Argumentation? (O Yes, O No, O Don't know); In case of argumentation, underline the point of view.

Diagram 1: facet-design test 1, the analysis of points of view in single disputes (16 structuples: 1 item per structuple)

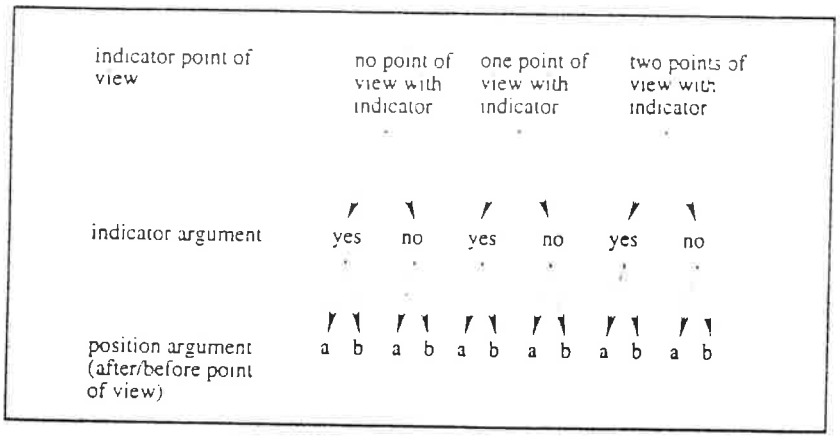


The following example illustrates the structuple indicator point of view (yes), single argumentation, indicator argument (yes), position argument (before): He cannot even put into words his own ideas, so according to me he is not a good chairman of the meeting. An example of a non-argumentative item is the following: I like to listen to the radio. My brother prefers watching television, especially when a horror film is broadcasted.

Test 2: analysing points of view in multiple disputes

The facet-design for the test measuring the skill in analysing points of view in simple multiple disputes contains 12 structuples. In each item the point of view is sustained with no more than one argument (single argumentation). The test contains thirty items: 12 items with simple multiple disputes, 8 items with simple single disputes and 10 non-argumentative items. Per item the following tasks had to be fulfilled: Argumentation? (O Yes, O No, O Don't know); In case of argumentation, underline the points of view.

Diagram 2: facet-design test 2, the analysis of points of view in multiple disputes (12 structuples: 1 item per structuple)



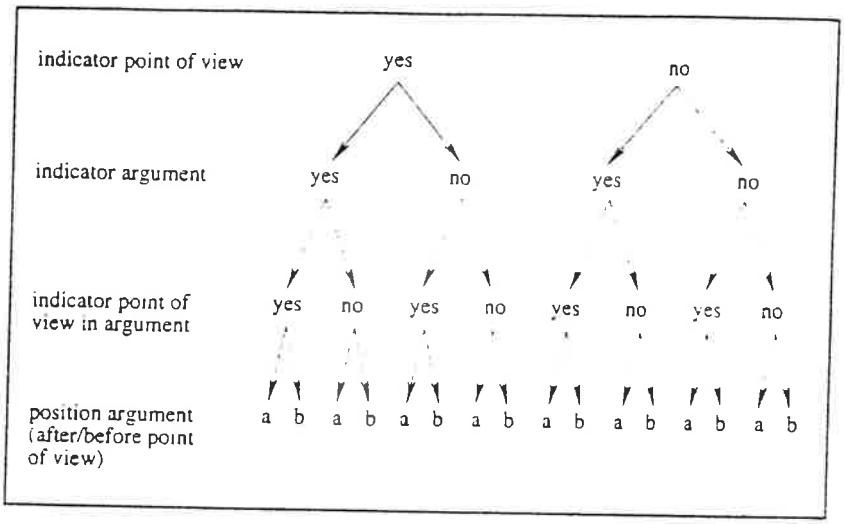
The following is an example from the structuple simple multiple dispute, indicators point of view (no), indicators argument (yes), position argument (after): She is a good writer of factual texts, because she is able to convey her opinions on paper in a clear way. She should not venture into writing literary texts though, because she is not that creative. An example of a non-argumentative item is: Adam got a new bike for his birthday. It was a black gentlemen's bicycle. He was very pleased with it, although he asked for a racer.

Test 3: analysing single argumentation

The facet-design for the test measuring the skill in analysing single argumentation contains 16 structuples. In each item the point of view is supported with no more than one argument (single argumentation). The test contains eighty-four items: 32

items with single argumentation and 16 non-argumentative items. Per item the following tasks were given: Argumentation? (O Yes, O No, O Don't know); In case of argumentation, underline the argument.

Diagram 3: facet-design test 3, the analysis of single argumentation (16 structuples; 2 items per structuple)

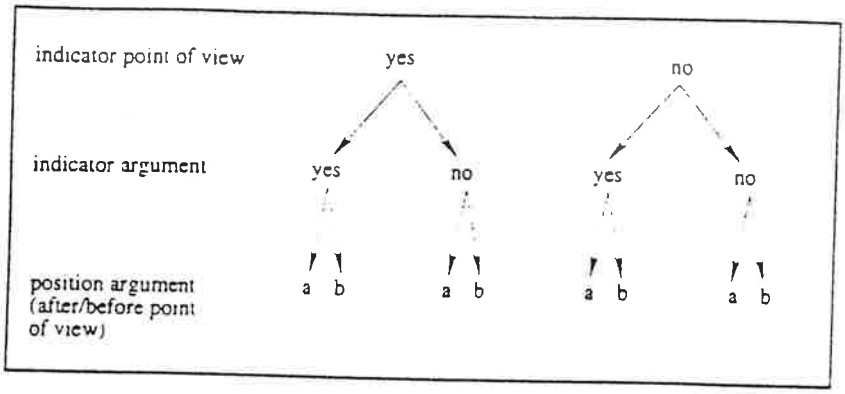


An example from the structuple indicators point of view (yes), indicator argument (yes), indicator point of view in argument (yes) and position argument (after) is: I think you must not employ John as a service-engineer, because in my opinion he is rather clumsy. The non-argumentative items were of the same format as in test 1.

Test 4: analysing multiple argumentation

The facet-design for the test measuring the skill in analysing multiple argumentation contains 8 structuples. In each item the point of view is sustained with two arguments (multiple argumentation). The test contains thirty-two items: 24 items with multiple argumentation, 8 items with single argumentation and 10 non-argumentative items. Per item students had to answer the multiple question "Argumentation?" (O Yes, O No, O Don't know) and in case of argumentation, they had to underline the argument(s).

Diagram 4: facet-design test 4, the analysis of multiple argumentation (8 structuples; 3 items per structuple)



An example from the structuple indicator point of view (yes), indicator argument (yes) and position arguments (after) is: In my opinion Joyce must sign up for a correspondence course, because it will increase her changes on an appointment and it will give her the possibility to meet some people. The non-argumentative items were similar to those in test 2.

3. Data collection

The complete test battery for the measurement of receptive and productive argumentation skills was presented in the fall of 1989 to students in the pre final year of the four major school types of Dutch secondary education: junior vocational, lower general, higher general and academic secondary education (for background information about these school types, see Oostdam & Emmelot 1991). A total number of 136 schools participated in the survey; per school all students of one class were tested.

The number of students tested and the reliability estimates (coefficient alpha) for the analysis questions (i.e. the underline questions) of the four tests are given in Table 1. The reliabilities are sufficient and indicate that the tests are appropriate to discriminate between students.

Table 1: Number of students tested and coefficient alpha per test (underline questions) for the argumentative items

	n of students	n of items	α
test 1	1749	16	.75
test 2	1691	20	.81
test 3	1758	32	.87
test 4	1718	32	.90

4. Research questions

The manipulation of test items according to the above-mentioned facets can have two sorts of effects. First, manipulation according to the facets may have a general effect on the difficulty of test items. The knowledge and strategies that are used to complete the items are more or less the same for all students. From a psychometric perspective this means that a one factor model fits the data best. Second, manipulation according to the facets may introduce specific effects. Different types of items can be solved by using different knowledge and strategies. A one factor model will not fit the data: in addition to a common factor specific factors for the levels of the facet(s) are needed to represent the data.

5. General effects of the facets

First we discuss effects of the facets on item difficulty. For all four tests an analysis of variance on mean item scores was carried out with facets as factors. In Table 2 the item means are given for the levels of the facets or factors. Since the items are dichotomous, their means can be interpreted as the proportion of correct responses.

Table 2: Effects of facets on item difficulty per test

facets		test 1	test 2	test 3	test 4
point of view indicator	yes	.65	.48	.67	.73
	no	.54	.46	.62	.67
argument indicator	yes	.62	.49	.66	.71
	no	.56	.42	.61	.69
point of view indicator in argument	yes	.63			
	no	.66			
argumentation	single	.54			
	multiple	.64			
argument position	final	.67	.58	.76	.75
	first	.51	.32	.53	.64

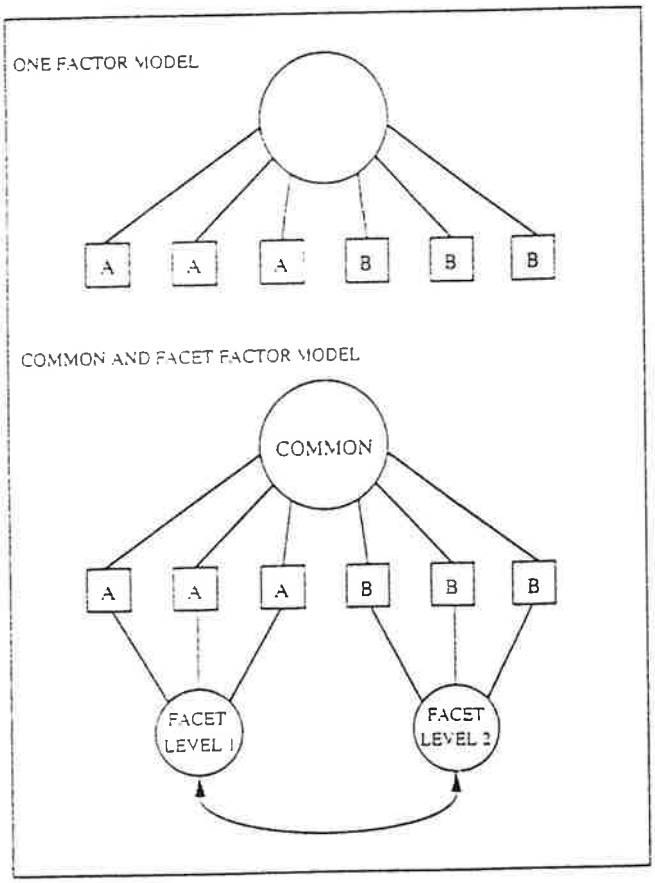
Argumentation with an indicator for the point of view or argument is identified somewhat better than argumentation without the presence of such indicators. This supports the assumption that formal indicators simplify the process of identification and analysis. The results of test 3 in which the argument contains an indicator for the point of view support these findings: many students are mislead by such a formal indicator. The results also reveal an effect for the way the point of view is sustained with single or multiple argumentation. When multiple argumentation is advanced the point of view is better identified. And finally, the position of the argument clearly influences the identification process. The sequence with the point of view in first and the argument in final position is

the easiest. Almost all differences between the levels of the facets are statistically significant.

6. Specific effects of the facets

If manipulation of the facets does not introduce opportunities for the use of different strategies to solve the items, all items in a test will measure the same underlying skill or trait. All items will have loadings on one and the same factor. In that case a one factor model (as visualised in the top of diagram 5) should offer a good description of the test data. If, on the other hand, manipulations of facets introduce multiple strategies for solving the items, a common factor will not be sufficient to describe the data. Extra facet factors will be needed to represent the structure of the data (see bottom of diagram 5).

Diagram 5: Factor Models



In table 3 the results of factor analysis of the four tests are summarized. One factor models give insufficient descriptions of the test data (GFI should be well above .95 for appropriate fit). Models with a common factor and two correlated factors for each facet describe the data very well.

Table 3: Goodness of fit one and two factor model

	one factor model	two factor model
test 1	.83	1.00
test 2	.79	.99
test 3	.63	.97
test 4	.77	.98

More interesting than the degree goodness of fit of the factor models is the relative importance of the facet factors. Do the facet factors account for a substantial proportion of the systematic item variance?

Table 4: Substantial facet factors

	facet factors	facet variance
test 1	argument position	5-10%
test 2	single/multiple dispute	5-10%
test 3	argument position	0-5%
test 4	argument position single/multiple argumentation	0-5% 5-10%

Two facets consistently have general effects only (see table 4). The presence and absence of indicators for points of view or arguments do not introduce different strategies for solving the items. Apparently there are (hardly) no students who solve items by paying exclusive attention to indicators. This interpretation corresponds with the finding that the effect on the difficulty level of the items was relatively small.

In three out of the four tests the facet of argument position introduces a specific factor. Apparently some students while solving the items rely heavily on the natural order of presenting a point of view in first and an argument in final position. Other students go beyond this superficial strategy. The absence of this sequence-factor in test 2 can be well understood, when we take into account that this test contains only a small number of items that allow for the successful use of this strategy.

In test 2 facet factors emerge for single versus multiple points of view. We assume that some students employ a superficial strategy that is based on the assumption that there is only one point of view in each item. This strategy can be applied successfully to half of the items.

In test 4 a similar explanation can be offered. We assume that the strategy of some of the students is based on the assumption that there is only one argument to each point of view. It can be understood that the factor does not emerge in test 1 and 2. Here, the students have to identify the point of view. A one argument assumption does not prevent the identification process, since the detection of one argument will often be sufficient to find the point of view (in test 3 this facet is absent).

7. Conclusion

The results of our study show that manipulation of test items according to a facet-design have a general effect on item difficulties. Almost all differences between the levels of the facets are statistically significant. An indicator for the argument(s) or the point(s) of view facilitates the identification and analyses of argumentation. A same effect on item difficulties obtain from the facet single or multiple argumentation: in case of multiple argumentation identification of the point of view is easier than in case of single argumentation. A relatively large effect is caused by the facet position of the argument. The sequence argument after the point of view is identified better than the reversed one.

Results of a factor analysis for all four tests showed that a two factor model fits the data better than a one factor model. All facets account for a proportion of the systematic item variance, most of all the position of the argument(s). In three out of the four tests the facet of argument position introduces a specific factor.

Coming back to the main question addressed in the beginning we may conclude to that argumentation skills are manyfold, rather than unidimensional. This does not only pertain to global distinctions between identification, analysis and evaluation. At the microlevel of items that form an apparently homogeneous test, manipulation of some facets does indeed introduce specific strategies.

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