Cognitive Operations in Constructing Main Points in Written Composition

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Two experiments were conducted. In the first, thinking-aloud protocols were collected from students in Grades 4, 6, and 8 and from adults who were planning an argument essay. Older writers constructed more sophisticated main points and took longer. Protocols revealed six types of problem-solving moves which a path analysis showed could account for the sophistication of the main point. In the second experiment, children in Grades 5 and 11 were asked to choose between good and bad paraphrases of a main point they had written. The choices and justifications of younger students suggested that they had not intended to produce a main point when they wrote. The results are interpreted in terms of knowledge-telling and knowledge-transforming models of composition. © 1988 Academic Press, Inc.

Comparisons of the composing processes of skilled and less skilled writers typically show differences in the operations performed on knowledge. Less skilled writers appear to do relatively little transformation of knowledge when processing it into written form, with the result that the selection and arrangement of content reflect what is salient in the mind of the writer (Flower, 1979). More skillful writers are found to carry out a variety of problem-solving operations involving content — identifying goals and constraints, searching, testing, revising goals, and modifying knowledge in response to gaps, inconsistencies, and the like that are encountered in the course of writing (Flower & Hayes, 1980, 1981; Scardamalia & Bereiter, 1987). As a result, skilled writers

sometimes profess surprise at what they find themselves having written and refer to writing as a process of discovery (Emig, 1977; Nystrand & Wiederspiel, 1977; Wason, 1980).

The studies to be reported in this paper focus on an aspect of written composition in which operations on one's existing knowledge are especially significant — the establishment of a main or central point in what is being written. Self-reports of skilled writers suggest that this is a major preoccupation and that it is the focus of much of the searching and rethinking that goes on when they write (Murray, 1978). Thinking-aloud protocols of novice writers, in contrast, show little in the way of concerns about main point (Burtis, Bereiter, Scardamalia, & Tetroe, 1983; Perl, 1979).

Research on identification of main points in reading has exhibited a similar divergence in findings. Kieras (1982) has obtained good fit to data on the identification of main points in simple expository texts with a model that uses mostly information from the surface structure of the text and involves relatively little inference from world knowledge. On the other hand, Johnston and Afflerbach (1985), studying skilled readers dealing with difficult texts,

found evidence of extensive problem-solving and inferential acitivity. In the case of reading, then, it appears that difficulty of the text can dramatically affect the kind of process that is involved in identifying main points.

The available evidence on writing suggests, by contrast, that the principal determinant of process is the expertise of the writer. This is consistent, however, with the more ill-defined character of writing tasks. In composition tasks, as Greeno (1978) has observed, much depends on constraints that are added by the problem-solver. Expert–novice comparisons indicate that, given the same assignment, expert writers tend to elaborate a more demanding set of constraints, thus in effect creating a more difficult task for themselves than is faced by novice writers (Flower & Hayes, 1980).

The present studies are motivated by the hypothesis that different models underlie construction of main points by expert and novice writers. The models are the knowledge-telling and knowledge-transforming ones of Bereiter and Scardamalia (1985a, 1985b, 1987; Scardamalia & Bereiter, 1987; Scardamalia & Paris, 1985). These contrastive models provide idealized descriptions of two structures for controlling the process of generating text content. The rationale for proposing two models, rather than attempting to explain expert–novice differences by variations within a single model, is elaborated in Bereiter and Scardamalia (1987). If the task were simply to explain the *deficiencies* of novice writing, then a single model would suffice. That model might, for instance, represent the planning and problem-solving operations involved in skilled composing (cf. Hayes & Flower, 1980), and the weaknesses of novice writing could be attributed to a lesser frequency or to a more primitive form of such operations. The more challenging problem, however, is to explain how novice writers manage to write as well as they do, given how little they manifest of

the mental activities that appear to play a vital role in composing as it is carried out by experts. The knowledge-telling model attempts to solve this problem by representing an alternative route to the attainment of coherence, organization, and topical relevance in writing—a route that does not depend on problem-solving activities directed toward such outcomes but that produces them as a by-product of procedures for generating text content. Experts are assumed to have flexible access to both the knowledge-telling model and to the more complex and effortful knowledge-transforming model, using whichever is appropriate to task demands, whereas novices are assumed to follow the simpler model for the most part, and to have access to the problem-solving model only under facilitative conditions.

The knowledge-telling and knowledge-transforming models are depicted in Figs. 1 and 2. We will not attempt a full explication of the models here, nor discuss evidence bearing on their validity (see, however, Bereiter & Scardamalia, 1985a, 1985b, 1987; Scardamalia & Bereiter, 1986, 1987; Scardamalia & Paris, 1985). For present purposes, attention may be restricted to the heuristic value of the models in suggesting alternative executive structures to account for observed differences in treatment of main point.

According to the knowledge-telling model (Fig. 1), content is generated by probing memory with topical cues, extracted from the task assignment or from text already generated, and with structural cues drawn from knowledge of the intended text genre. The coherence, organization, and topical appropriateness of the text depend on the prior organization of memory and on the effect of discourse conventions. Given a familiar topic and a well-practiced genre (such as narrative or argument), a sensible and well-formed text can emerge even though the writer's attention is occupied only with problems of thinking of enough to say and of how to express it.
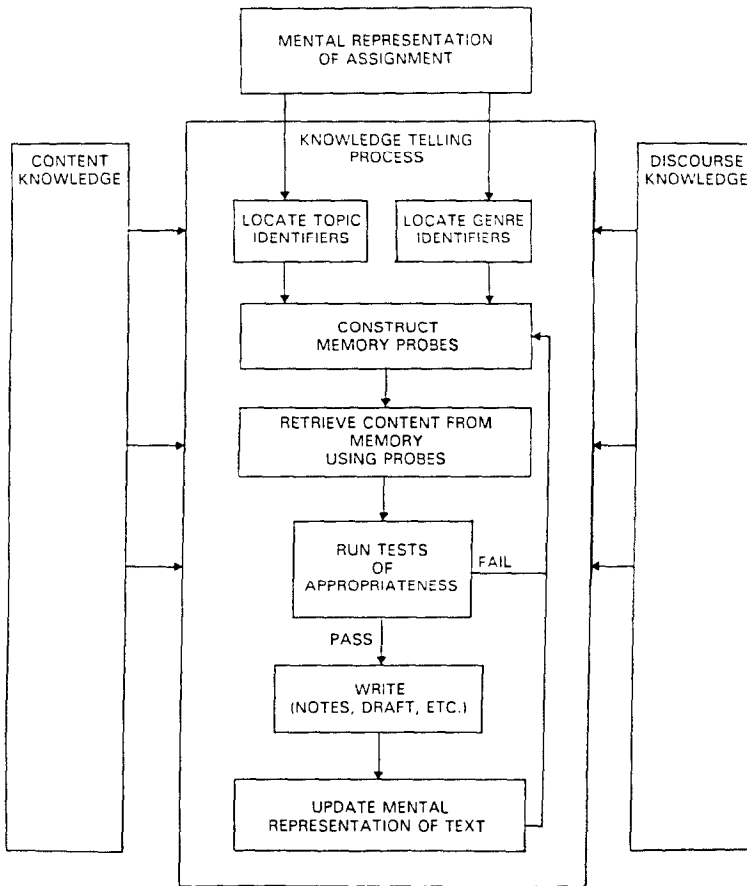
FIG. 1. Structure of the knowledge-telling model. This model is an adaptation of a model first presented in Bereiter and Scardamalia (1985a).

The knowledge-transforming model (Fig. 2) is more complex in that content generation is subordinated to activity in two problem spaces: a content space in which problems of belief, logical consistency, and the like are worked out, and a rhetorical space in which problems related to attaining goals of the composition are dealt with. The model posits a dialectical process whereby goals in one space may be translated into problems in the other space. For example, the rhetorical goal of strengthening an argument might be translated into the content problem of finding an example for a belief, and attempts to solve this content problem might then lead to a revision of the belief, and back to a change in the original rhetorical goal. (Other examples of dialectical processes are provided in Scardamalia & Bereiter, 1985). This process of reciprocal activity in linked problem spaces is hypothesized to account for the experiences of surprise and discovery reported by expert writers.

Establishment of a main point in the knowledge-transforming model entails intentional pursuit of a main point as a goal. This would typically involve the interactive solving of content problems (for instance, deciding what is the crucial issue relevant to the topic at hand) and rhetorical problems (for instance, deciding which point would be most convincing). Through such problem-solving efforts the main point would be expected to take shape gradually in the course of planning. The writer would
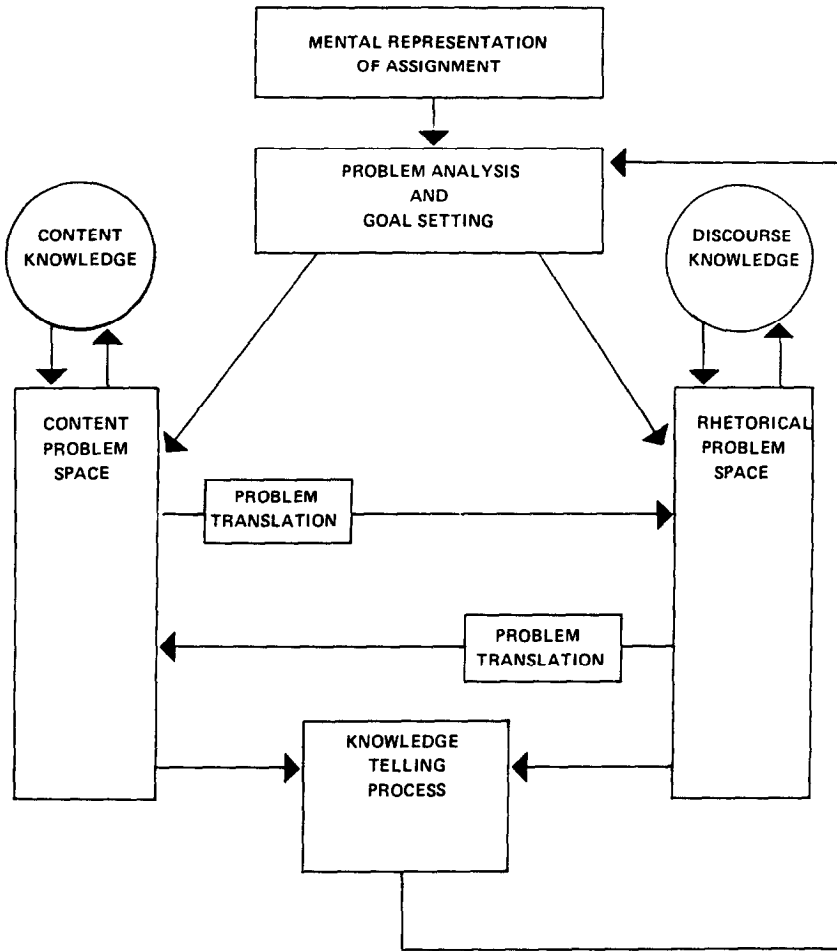
Fig. 2. Structure of the knowledge-transforming model.

be expected to engage in knowledge-di-
rected operations that contribute to the de-
velopment of the main point, to arrive at a
main point that represents a refinement of
the writer's initial knowledge for the pur-
poses of the composition, and to be aware
of the main point that emerges.

If these problem-solving procedures rep-
resented the only way that a main point
could be produced, then it would be ex-
pected that novice writing would be char-
acterized by absence of a main point. Al-
though such writing does occur, large-scale
assessments indicate that the common
problem is failure to develop or support
points adequately, not absence of a main
point altogether (National Assessment of

Educational Progress, 1980; Nordberg,
1981). This suggests an alternative route,
implying the need for an alternative model
of composing to account for main points in
novice writing. The knowledge-telling
model provides several ways in which a
main point could emerge in the absence of
procedures for deliberately searching for or
constructing one. For example, when
memory content is elicited by topical cues,
then the information that is most salient
would be likely to be retrieved early and to
provide cues for the retrieval of related in-
formation, thus assuming a dominant place
in the composition. Or if the structural re-
quirements of a particular genre include a
dominant element, for example, a position

supported by reasons, then a consequence of probing memory with these structural cues might be that the dominant element assumes the status of a main point. In any event, the main point that emerged would represent knowledge already available in memory rather than knowledge constructed during the composing process—a result that is consistent with the findings concerning lack of development and support of main points in novice writing.

The alternative routes to main point construction suggested by the knowledge-telling and knowledge-transforming models should yield observable differences along at least three dimensions: (a) the degree to which problem-solving effort is directed toward the development of a main point, (b) the degree to which the main point represents a refinement or development of the writer's initial knowledge as opposed to a straightforward application, and, in consequence, (c) the degree of awareness that the writer has for the main point of the composition.

The two studies which follow test more specific versions of these general predictions and provide in addition details of the way in which writers go about constructing main points. In these studies school grade level (ranging from fourth grade to graduate school) was used as the a priori basis for identifying groups differing in their likelihood of following the two models. The use of school grade level as a sorting criterion contrasts with the more typical procedure in writing research of using subjects who are all adults but who differ markedly in their accomplishment as writers (e.g., Flower & Hayes, 1981; Schumacher, Klare, Cronin, & Moses, 1984). No matter how differences in writing expertise are established, however, experts are sure to differ from nonexperts in a variety of other nonrandom ways that are difficult to assess and control. Educational level is no more free of this difficulty than any other sorting criterion, but it has the advantage of providing a continuous scale that can reason-ably be expected to correlate with writing expertise across its full range. By contrast, the more usual ways of discriminating expertise—for instance, identifying professional writers as experts or students assigned to remedial writing courses as novices—tend to pick out extreme groups and not to provide scalable measures.

STUDY 1

The purpose of this study was to test hypothesized relationships between processes and products, as implied by the knowledge-telling and knowledge-transforming models. Process variables were drawn from thinking-aloud protocols collected during the course of planning an opinion essay. These were related to ratings of the main points actually achieved in the essays. On the process side, the use of a knowledge-transforming as opposed to a knowledge-telling approach was expected to be revealed by the following: (1) a greater length of time taken to arrive at a statement of main point during planning, as a result of the greater amount of rhetorical and content-related problem-solving required by a knowledge-transforming procedure, (2) a higher frequency of specific moves indicating pursuit of a main point as a goal or translating between rhetorical problems and content problems, these being distinguishing characteristics of the knowledge-transforming process.

On the product side, it was predicted that main points arising from knowledge-telling procedures would be closely tied to the explicit task assignment and to genre conventions, these being the initial sources of probes for retrieving memory content to use in the essay. Main points arising from knowledge-transforming processes, on the other hand, were expected to represent novel constructions that were compatible with the assignment and with genre conventions but that went beyond them in some textually appropriate way. It was predicted that the process measures would ac-

count for variance in product ratings over and above variance accounted for by age.

Method

Subjects

Twelve subjects from Grade 4, eleven from Grade 6, thirteen from Grade 8, and six adults participated in the study. Children were randomly selected from classrooms at a middle class school in suburban Toronto; adults were volunteers from a university course in education.

Instructions

All students were instructed to write a composition of about a page on the topic "Should children be able to choose the subjects they study in school?" and to plan as much as possible before writing. Children were introduced, through brief discussion and demonstration, to five things that they might consider while planning: content, goals, reader, problems, and integration. These five types of planning were also mentioned to adults, but without discussion and demonstration, which were considered inappropriate. All subjects were given pencil and paper and encouraged to make notes during planning. They were also instructed briefly in thinking aloud and asked to continuously do so while planning. Prompts to talk were given during planning whenever the subject fell silent. In order to encourage planning, a single prompt was given to try to plan more, at the point when the subject was first ready to write.

Procedure

Each student was seen individually for a single session, during which the instruction, planning, and writing took place. A typical session lasted 45 min to an hour. The thinking-aloud (planning) segment was tape recorded, and the tapes were subsequently transcribed.

Coding of Constructive Moves

The thinking-aloud protocols were examined for instances of six different types of moves that could be inferred as characteristic of a knowledge-transforming as opposed to a knowledge-telling model of composition. The features of the knowledge-transforming model used as a basis for inferring these characteristic moves were (a) the problem analysis and goal-setting component of the model, which leads to the expectation that goal-directed activity specifically directed toward establishing a main point will be observed, and (b) the two problem spaces, content and rhetorical, with the expectation that activities will be observed that take the results of operations performed in one problem space and subject them to operations in the other problem space. The six types of moves, which we will refer to generically as *constructive moves*, are as follows:

1. *Search.* Search involves explicit pursuit of a main point as a goal, either in the rhetorical space, where it is treated as the focus of the composition, or in the content space, where it is treated as a problem of determining what the writer actually believes. Instances of search included specific statements of intention to find a main point, evaluation of prospective main points, and generation of ideas leading toward identification of a main point.

2. *Delimit.* The writer decides to restrict attention to a particular subset of ideas. Explicit delimiting of the topic was considered a knowledge-transforming move because it represents a rhetorical decision that imposes a constraint on search through the content space.

3. *Fit.* The writer considers how particular content could fit with a particular main point. This may vary from simply drawing a connection between the main point and another idea to deciding on how to reconcile a conflict. Solutions to problems of fit may be rhetorical (for instance, rephrasing

the statement of main point so that it fits the content) or they may involve search for content that is compatible with the main point.

4. *Cohere.* The writer considers or assesses how or whether all the various ideas that have been generated might fit together. This type of move fits the knowledge-transforming model in that it involves taking the results of operations in the content space and operating on them in pursuit of the rhetorical goal of coherence. Such a process is to be contrasted with the direct translation of content into text statements, which is characteristic of the knowledge-telling model.

5. *Structure.* The writer chooses an organizing structure for text content, such as "pros and cons," or "early years, middle years, and late years." This is another example of a rhetorical move that constrains search for content.

6. *Review.* The writer reviews the ideas that have been decided on so far. Backtracking over a few ideas does not count: The writer must be looking at how the whole effort stacks up so far. This type of reviewing may be thought of as a problem-finding move in which problems may be identified that require further work of any of the previously mentioned kinds. Review is thus indicative, in a nonspecific way, of planning carried out according to a knowledge-transforming model.

Two raters inspected each thinking-aloud protocol for the occurrence or absence of each of the six constructive moves, with 90% agreement. The number of different moves, out of six possible, was then scored for each protocol. The correlation between raters for this score was .88.

Rating of Main Point

Each thinking-aloud protocol was examined for evidence of a main point that the student was planning to use in his or her essay. Three levels of main point were identified: (1) There was no clear main point, or the main point was just a statement of the topic, or a minor variation of it (for example, "No, I don't think students should choose"). (2) The main point was an extension or qualification of the topic (for example, "Children in high school should choose, but not in grade school"). (3) The main point was a point about the topic but one that was essentially different from the topic itself and that expressed some distinct theme or insight that could serve as the basis for the argument developed in the essay (for example, "The degree of choice should increase with age").

A level 1 main point corresponds to what would be expected from planning carried out according to the knowledge-telling model, where the main point would typically be a by-product of retrieving content using cues based on the assignment and on genre conventions. Thus the most common level 1 main point was simply a positive or negative response to the question posed in the topic assignment, "Should children be allowed to choose the subjects they study in school?" A level 3 main point, on the other hand, would be unlikely to result from such a process but would rather result from problem-solving activity directed toward establishing a main point. A level 2 main point is indeterminate as to which model it might reflect. The writer might already have in memory an elaborated or qualified belief about the assigned topic, which could simply be retrieved and incorporated into the text plan according to the knowledge-telling model. Alternatively, elaboration or qualification of the belief could reflect knowledge-transforming operations carried out during composition planning, but not carried so far as to attain the distinctive kind of main point that would be scored as level 3.

Two raters independently rated all protocols following the above description of the scale ($r = .71$), and disagreements were resolved in conference. The same scale was

then used by both raters to rate main points in the written texts ($r = .83$), with disagreements again being resolved in conference.

Although both the coding of constructive moves and the rating of main points were derived from the same set of theoretical expectations, they are empirically distinct; that is, there is nothing in the scoring scheme for level of main point which ensures that a highly rated main point will be associated with a high frequency of constructive moves or that a low-rated point will not be accompanied by such moves. For instance, a writer could carry out deliberate search for a main point, delimit the topic, devote attention to fit, coherence, and structure, review the plan several times, and still end up with a main point such as, "I don't think that kids in grade school should be able to choose," which would be rated as level 1.

Results

Level of Main Point

The level of main point reached by students in their texts and plans is shown in Table 1. The correlation between rated level of main point in the plan and text is high ($r(40) = .79, p < .01$), considering that the plans and texts were rated completely independently. In 34 of the 42 cases (81%), the level of main point reached in the text was the same as that reached in the plan, and in the remaining cases there was a discrepancy of one level.

TABLE 1
NUMBER OF STUDENTS WITH MAIN POINT AT EACH
LEVEL IN PLAN AND TEXT

Level of main point in plan	Level of main point in text			
	1	2	3	Total
1	19	5	0	24
2	3	11	0	14
3	0	0	4	4
Total	22	16	4	

Time to Main Point

An indicator of amount of problem-solving activity going into the development of main points is the amount of time that elapses between the beginning of planning and the earliest statement of the main point. Elapsed time was taken from the tape recordings as the time from the beginning of the thinking-aloud protocol to the main point identified by coders for the earlier rating. The distribution of these times to main point was positively skewed and bimodal, with one mode at less than 1 min, and the other mode at about 6 min. The skew was removed by taking the square-root. The correlation between the level of main point achieved and the (square-root of) time taken to achieve it was .67 ($df = 40, p < .01$). For students reaching a main point of level 1, the median time to main point was about 15 s, while for those reaching a main point of level 2 or 3, it was about 6½ min. Thus, the writers who reached high levels of main points achieved them only after extended periods of effort.

Constructive Moves

The strategies of students reaching high- and low-level main points were compared by classifying students according to the level of the main point in their plan and also classifying them according to whether they did or did not make use of each of the six constructive moves described in the Method section. Table 2 shows the mean number of different types of moves used at each level. Students who achieved higher levels of main point in their plans used significantly more types of moves ($F(2,39) = 51.20, p < .01$), showing that these types of whole-text considerations are related to the achievement of high-level main points. Furthermore, this relationship carries over to the text. Students who achieved higher levels of main point in their texts used significantly more types of moves in planning those texts ($F(2,39) = 42.79, p < .01$). Use

TABLE 2
MEAN NUMBER OF DIFFERENT TYPES OF
CONSTRUCTIVE MOVES (MAXIMUM = 6) AS A
FUNCTION OF LEVEL OF MAIN POINT

Level of main point	n	Number of moves		
		M	SD	Range
In plan				
1	24	0.17	0.38	0–1
2	14	1.14	1.23	0–4
3	4	4.75	1.26	3–6
In text				
1	22	0.23	0.43	0–1
2	16	0.94	1.24	0–4
3	4	4.75	1.26	3–6

TABLE 4
LEVEL OF MAIN POINT AND NUMBER OF DIFFERENT
CONSTRUCTIVE MOVES AS A FUNCTION OF GRADE

Grade	Level of main point in plan		Level of main point in text		Number of different moves	
	M	Range	M	Range	M	Range
4	1.17	1–2	1.25	1–2	0.25	0–2
6	1.36	1–2	1.27	1–2	0.55	0–2
8	1.46	1–2	1.62	1–2	0.31	0–1
A	2.67	2–3	2.67	2–3	4.33	3–6

of the six types of constructive moves that we are considering is therefore highly associated with the achievement of high-level main points.

Data for individual moves are presented in Table 3, which shows the number of students using each of the six types of constructive moves according to rated level of main point in the plan. Each of the six types shows a steep increase in relative frequency at higher levels of main point. Thus level of main point does not seem to be associated with any particular kind of constructive move, but rather to be associated with all relevant kinds.

Grade

Developmental data on level of main point and use of constructive moves are shown in Table 4. Grade-level differences were significant in each case—for level of

main point in plan ($F(3,38) = 14.00$, $p < 1.01$), for level of main point in text ($F(3,38) = 13.53$, $p < .01$), and for number of different kinds of constructive move ($F(3,38) = 54.24$, $p < .01$). As indicated by the F values, however, the age-related difference in use of constructive moves was much greater than the differences in level of main point.

To determine whether there was a relationship between constructive activity and main point independent of grade level, within-grade correlations were examined. The pooled within-grade correlation of number of constructive moves with main point in the plan was significant ($r(37) = .49$, $p < .01$), showing an effect of constructive activity on reaching a high-level main point apart from the common grade effect. The corresponding value for main point in the text was lower, but also significant ($r(37) = .33$, $p < .05$). It should be noted that these within-grade correlations underestimate the actual relationship be-

TABLE 3
PERCENTAGE OF STUDENTS USING EACH TYPE OF CONSTRUCTIVE MOVE AS A FUNCTION OF LEVEL OF MAIN
POINT IN PLAN

Level of main point in plan	n	Constructive Move					
		Search	Delimit	Fit	Cohere	Structure	Review
1	24	0	0	4	4	8	0
2	14	28	14	7	21	21	21
3	4	50	75	75	100	75	100

tween constructive moves and level of
main point because they eliminate that part
of the variance in constructive activity
arising from maturation and educational
experience. The path analysis, to be re-
ported next, was aimed at identifying the
causal role of such factors.

Path Analysis

Correlations between all variables are
shown in Table 5. The correlations are all
significant ($df = 40, p < .05$). In these cor-
relations, age was coded as 1, 2, 3, and 6,
for Grades 4, 6, 8, and Adult, respectively.
The value of 6 for adults, although some-
what arbitrary, represents an effort to take
into account both the greater absolute size
in years of the interval between Grade 8
and adult, as compared to the intervals be-
tween Grades 4, 6, 8, and also the tapering
off in growth of most mental abilities after
adolescence (cf. Bloom, 1964). Again, the
square-root of time to main point was used.

A path analysis was carried out to obtain
a more coherent picture of the causal rela-
tionships among variables in the study.
Time to main point was not included be-
cause preliminary regression analysis indi-
cated that it did not add any predictive
power to that provided by number of con-
structive moves.

Path analysis requires prior assumptions
of causal ordering. The assumptions made
in the present analysis are shown by the
arrows in Fig. 3. Most of these assump-
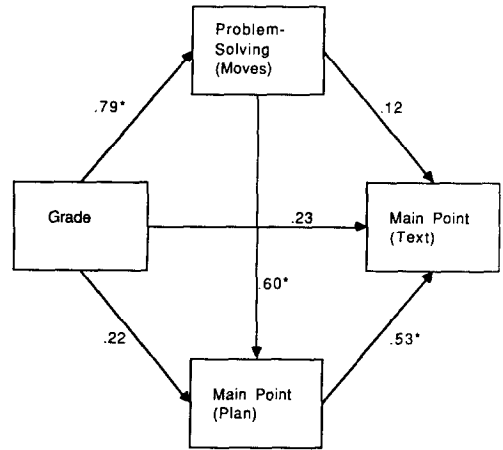tions are natural—for example, that grade

FIG. 3. Path analysis of variables contributing to
level of main point in text. *$p < .05$.

level can affect the other three variables,
but not the reverse. It may be noted that, in
principle, level of main point in the text
could influence constructive moves and
level of main point in planning, as well as
the reverse; that is, what is written can af-
fect the planning process, as well as the
planning process affecting what is written
(Flower and Hayes, 1981). In the present
study, however, protocol data pertain only
to planning carried out before writing actu-
ally began, and so the causal influences
were necessarily unidirectional.

Figure 3 shows the path coefficients ob-
tained, based on standardized regression
weights. The causal path shows that grade
level affects constructive activity, which in
turn affects level of main point in the plan,
and this affects the level of main point in
the text. Each of these path segments has a
statistically significant weight and none of
the others do. Grade level has relatively
little direct effect on level of main point in
plan or text. Rather, its effects are almost
entirely mediated through amount of con-
structive activity.

Discussion

Two results of Study 1 are particularly
relevant to the issue of whether different
processes are at work in the production of
main points in expert and novice writing.

TABLE 5
PEARSON CORRELATES BETWEEN MEASURES

	Grade	Moves	Time	Main point in plan
Moves	.79**			
Time	.37*	.50**		
Main point in plan	.70**	.78**	.67**	
Main point in text	.70**	.72**	.53**	.79**

* $p < .05$.
** $p < .01$.

One is the bimodal distribution of times to main point, with the two modes differing by an order of magnitude. The other is the almost total absence of constructive moves in the protocols of writers producing the lowest level of main point. Both results are consistent with the models presented in the introduction. Those models provide one way of reaching a main point (knowledge-telling) that is quick and relatively free of effort directly involved with achieving a main point, and another (knowledge-transforming) that is slower and characterized by a variety of planning and problem-solving operations.

The very sharp separation of the data in accordance with the two models is surprising, since one would not expect that expert main point construction would invariably require extended problem-solving. A writer might, for instance, have previously argued the same issue and therefore be able to retrieve a level 3 main point from memory intact (cf. Murray, 1983). The assigned topic, whether children should be allowed to choose the subjects they study in school, is one that we have used in a number of other studies because it appeared to be motivating to writers over a large range of ages. Perhaps this means that it provides a sufficiently novel issue that writers are unlikely already to have well-formed arguments available in memory, so that writers who have knowledge-transforming procedures available are likely to use them. The particular operations uncovered in the thinking-aloud protocols are consistent with the premise that knowledge-transforming involves the interactive solution of content-related and rhetorical problems. That these operations are instrumental in formulating main points is indicated by the path analysis results, which show constructive moves to be the principal determinant of main point ratings, mediating the effect of age differences.

STUDY 2

The most direct empirical implication of the two-model hypothesis is that process-tracing methods should reveal distinctly different ways that writers go about generating main points in composition planning. This implication was investigated in Study 1. However, if the two models validly delineate different ways the composing process runs, then the models should have other, less obvious empirical implications as well. In Study 2 we test model-based predictions concerning *memory* for main points.

Previous research (Scardamalia & Paris, 1985) indicated that there was little age-related difference in writers' verbatim memory for recently written text, but that differences appeared in (a) memory for more abstract characteristics, such as intention and gist, and in (b) the text features that were referred to in the process of trying to recall particular details. In the present study, more specific predictions were tested concerning the accuracy of writers' memory for main points and the evidence they would appeal to in supporting their judgments of main point statements.

In Study 2 writers were asked to evaluate statements of the main point of a composition they had written previously. These statements were specially prepared, some to be accurate and some to be inaccurate in that they emphasized subsidiary rather than main points. One prediction was that writers using a knowledge-transforming approach would, because of problem-solving efforts directed toward establishing a main point, be able to discriminate between accurate and inaccurate statements of their main point. In contrast, it was expected that writers using a knowledge-telling approach, and whose main point therefore emerged incidentally, would be less able to distinguish an accurate main point statement from statements of secondary points, provided both kinds of statements described content actually in the text. The second prediction concerned writers' justifications for why particular statements

were or were not good statements of their main point. Writers using a knowledge-transforming approach were expected to show a greater tendency to appeal to their own intentions at the time of writing as a basis for accepting or rejecting a suggested main point statement. For writers following a knowledge-telling procedure, such intentions would not have played a role in the original production of the main point and therefore they would be less likely to be available as a basis for judgment.

As in Study 1, age was used as a sorting criterion. Previous research had indicated no age difference in writers' verbatim memory for what they had written (Scardamalia & Paris, 1985). Consequently, the main point statements used in the present study were all accurate in that they reflected content actually included by the writers, but they varied in focusing on content that was central or incidental to the text. The previous research had also indicated that adults readily recalled their intentions for previously written texts, while this was more uncertain for school-age writers. Accordingly, the present study focused on an age range (Grades 5 to 11), where it was expected that discrimination of accurate and inaccurate main point statements would present a challenge and where the extent of prior thinking about main point could be expected to have a significant effect on performance.

Method

Participants were 32 students from Grade 5 and 32 from Grade 11 from middle-class urban elementary and secondary schools. After writing a one-page essay on the topic "An occupation that is not appreciated enough," in group sessions, students were asked to write down what they considered to be the main point of their essay. They were then randomly assigned to one of the following individually administered treatments ($n = 8$ per condition per grade):

1. *Own condition.* Students received a paraphrased version of their own statement of their essay's main point.

2. *Upgraded condition.* Students received a statement intended to bring the main point into sharper focus than was done either in the original essay or in the student's own statement of main point.

3. *Downgraded condition.* Students received a statement that highlighted a subordinate point of the original essay.

4. *Three-choice condition.* Students received statements of all three of the preceding types.

An example of the three different kinds of main point statements is given in Table 6. In the first three conditions (own, upgraded, and downgraded) students were informed that someone had read their essay and had written a statement of what they though the main point was. They were asked to read the statement and discuss how well the statement fitted the main point of what they were trying to say in their essay. Thus students were required to make a judgment with nothing to compare a statement to except their memory for their own composition. In the three-choice condition, students were asked to read the three versions and rate them from best to worst according to how well each one expressed the main point of their essay, and to explain their choices. Thus the three-choice condition permitted a finer discrimination of students' accuracy in judging main point statements, but at the same time it provided them with more information to go on. Students did not have their original essays available, so that in all conditions they had to rely on their memory for what they had done while writing.

Results

Evaluations of Main Point Statements

In the three-choice condition, each student's ranking of the three main point statements was correlated with the intended ranking (upgraded > own > downgraded). In Grade 5 the mean rank-order

TABLE 6
EXAMPLE OF ORIGINAL ESSAY AND EXPERIMENTAL VARIATIONS OF MAIN POINT STATEMENTS

Original Essay

The work of the "Caretakers" or "Janitors" in Canadian schools is not fully appreciated by students or teachers. These "Caretakers" have a seemingly never ending list of jobs that must be done to keep a school clean, presentable, in some ways comfortable but most importantly, they keep our schools functioning. These tasks include taking care of the lawns and fields surrounding the schools, shoveling snow, looking after furnace rooms, replacing burnt-out lights, and in the case of many high schools, keeping a swimming pool warm, safe, and hygienic. In short, these "Caretakers" do take care of our schools.

Unfortunately, almost all students and teachers do not appreciate the effort being made by the Janitors of their school. Students make the job much more tedious; garbage is tossed onto the floor or stuffed into odd spaces (e.g., behind a banister), and vandals knock holes in walls, break glass doors, and carve into everything. Students and teachers should not take "Caretakers" for granted; imagine the mess our schools would be in if they ever went on strike.

Paraphrase of Own Statement

It seems to me that the main point Jesse is trying to make is that caretakers should be appreciated more by students and teachers because they are necessary to keep the schools running. They do a lot for our schools, yet the people who use the schools sometimes make it more difficult for them.

Upgraded

The most important point I get from Jesse's essay is that caretakers should be appreciated more for keeping our schools comfortable and functioning. They do this by performing a never-ending list of jobs. This job is made harder, however, by students, teachers, and vandals who create unnecessary work for them through carelessness.

Downgraded

I think the main point Jesse is getting at is that caretakers should be appreciated more because vandals create so much unnecessary work for them that their job is never done. Vandals knock holes in walls, break doors, and generally make life more difficult than it needs to be. Janitors also have all the regular school jobs to do, so they are kept constantly busy.

correlation was exactly zero. In Grade 11 the mean was 0.56. The difference in means is significant at the .05 level ($t(14) = 2.18$).

In all conditions, students were asked whether their main point was made more clearly in their original essay or in the main point statement provided by the experimenter. If students were aware of their own main points, it was expected that those in the downgraded condition should strongly prefer their own text, those in the own condition should have mixed reactions, those in the upgraded condition should tend to prefer the presented main point, and those in the three-choice condition should show an even stronger preference for the presented statement, since they would have chosen it as the best among three possibilities.

Table 7 shows that the choices of Grade 11 students conformed to the predicted rank order: three-choice > upgraded > own > downgraded. Among Grade 5 students the order is nearly the opposite. A statistical test was provided by converting the choices shown in Table 7 to scores as follows: preference for presented main point = $+1$; equivocal preference = 0; preference for original essay = -1. A two-way analysis of variance (Grade $\times$ Condition) on these scores, including tests for the hypothesized linear trend, showed that for the two grades combined there was virtually no overall linear trend ($\psi/w = 0.075$, $F(1,56) < 0.1$; variables are as defined in Hays, 1963, p. 556). For Grade 11, however, there was a positive linear trend ($\psi/w = 1.05$) while in Grade 5 there was a negative trend ($\psi/w = -0.90$). The difference between trends is significant at the .02 level ($F(1,56) = 6.69$).

Students in Grade 11 thus behaved as would be expected of writers who had a definite idea of their main point. When given several main point statements they tended to choose them appropriately, and their judgment of whether the main point was made more clearly in the statement or in the original text varied according to the quality of main point statement provided. Grade 5 students, however, showed no indication of valid discriminations among main point statements. Their ranking did

TABLE 7
DISTRIBUTION OF JUDGMENTS AS TO WHETHER MAIN POINT WAS MADE MORE CLEARLY IN THE PRESENTED
STATEMENTS OR IN THE ORIGINAL TEXT

	Grade 5			Grade 11		
Condition	Statement clearer	Text clearer	Equivocal	Statement clearer	Text clearer	Equivocal
Own	5	3	0	3	3	2
Upgraded	6	1	1	3	0	5
Downgraded	7	1	0	1	2	5
Three-choice[a]	2	3	3	6	1	1

[a] In the three-choice condition, comparison is between original text and the preferred one of the three main point statements.

not correlate with intended ones, and when given a single statement, they tended to accept it as a better representation of their main point then their essay itself. As Table 7 indicates, this tendency was as high with downgraded statements as with upgraded ones.

Justifications of Downgraded Versions

Support for the conclusion that Grade 5 students did not discriminate statements of subsidiary points from statements of main point comes from justifications in the two conditions where students were exposed to a downgraded version of their main point. These justifications show that 85% of the Grade 11 students made reference to an idea being peripheral or only a detail, whereas only 20% of the Grade 5 students did so ($\chi^2(1,N = 32) = 11.63, p < .001$).

Appeal to Intention

Students were probed for justifications of their answers to two questions: how well the presented statement interpreted the main point of their essay, and whether the statement or the original essay better expressed their main point. These justifications were independently scored by two raters as to whether or not they appealed to the writer's intention. A justification based on intention was defined as one that could be made with warrant only by the writer,

whereas a text-based justification could be made by any reader. Thus intentional justifications were typically signaled by phrases such as "what I really meant" or by explanations of why a particular text statement was made (for example, "That was something I just put in to make it interesting"). Two students in each grade were omitted from this analysis because of inadequate tape recordings.

The great majority of justifications (88% in Grade 5, 68% in Grade 11) contained no reference to the writer's intention. Consequently, students were classified as to whether they showed any intentional justifications in response to either question. This analysis was carried out at three levels of probing: spontaneous remarks of the subject, responses to the first probe, and responses to later probes. The first probe was a simple request for further explanation, while later probes often used phrases such as "what you meant" and "what you were trying to say," and thus were somewhat directive for intention-related statements. Interrater agreement on whether a student showed appeal to intention was .90.

Table 8 shows the frequency of students for whom both raters noted at least one appeal to intention. After the first probe, 20% of Grade 5 students showed an appeal to intention, while 60% of the Grade 11 students did so ($\chi^2(1,N = 60) = 10.00, p <$

TABLE 8
CLASSIFICATION OF STUDENTS ACCORDING TO USE
OF APPEAL TO OWN INTENTION IN JUSTIFYING MAIN
POINT EVALUATIONS

Condition	Grade 5 Appeal to Intention		Grade 11 Appeal to Intention	
	Some	None	Some	None
Own	1	5	4	4
Upgraded	2	6	6	1
Downgraded	2	6	3	4
Three-choice	1	7	5	3

.01). Under further probing, these proportions increased to 47% and 84% respectively, and for spontaneous statements only, the proportions are 20% and 50%. The differences between grades remain significant beyond the .05 level by either criterion. Even under probing, therefore, the percentage of Grade 5 students who made any reference to their own intentions in their essays remained below 50%, and without specific probing the percentage was 20%.

Discussion

Both model-based predictions were supported by statistically significant differences between the Grade 5 and Grade 11 groups: (1) the younger students could not reliably distinguish accurate from inaccurate statements of main points in their own compositions, whereas the older students could; and (2) the older students tended to appeal to prior intentions in justifying their evaluations of main point statements, whereas few of the younger students did so. The second finding is important for interpreting the first. The age differences in ability to discriminate among main point statements could be attributed to comprehension differences rather than writing process differences. However, the reasons given for the discriminative judgments support the hypothesis that mental activities during writing played a part in the subse-

quent responses to main point statements.

The differences observed in Study 2 are not as clear-cut as in Study 1. This may be partly attributed to the restricted age range, but more importantly to the fact that Study 1 dealt with process differences, which should fairly directly reflect model differences, whereas Study 2 dealt with performance differences, which are subject to many additional influences. It is therefore the reliability and the fit of results to model-based predictions rather than the magnitude of the differences that is relevant.

Although the quality of main points was not an issue in this study, it is worth noting that experimenters charged with producing the various statements of main point used in the experimental procedures never found themselves unable to locate a main point in a student's text. This observation speaks to the need for a model that shows how main points can be produced even by writers who fail to recognize their own main points and who show no evidence of having intended to produce one.

GENERAL DISCUSSION

The present results on the development of main point in writing are consistent with the general view of the organization of the writing processes that was suggested in the introduction. The essential difference represented in the knowledge-telling and knowledge-transforming models is the distinction between composing as a routine process of content generation and composing as a problem-solving process concerned with the joint solution of rhetorical and content-related problems. The results of the present studies extend this view of differences in writing approaches to the area of a writer's concern with the main point of a composition.

In Study 1, writers were classified according to the extent to which they developed a distinctive main point that served to

integrate their composition. It was found that behind the highly rated main points lay a variety of problem-solving activities concerned with identifying, focusing, evaluating, and linking information to a main point. In agreement with the two proposed models, such activities were almost wholly missing from the protocols of students producing low-rated main points. As would be expected, age differences were found in both process and achievement, but within-group correlations and a path analysis indicated that problem-solving activity was significantly associated with main point development independently of age and that the effect of age was almost entirely mediated through its effect on problem-solving activity.

In Study 2, developmental differences were observed that were predicted from the assumption that the younger writer's approach to writing tends to follow the knowledge-telling model whereas the older writer's approach tends more often to follow the knowledge-transforming model. Although the knowledge-telling process is capable of generating texts that have an identifiable main point, it does not involve effortful construction of or operations on such a point. Accordingly, most of the younger students were not able to discriminate between accurate and distorted statements of their main points, and in defending the judgments they did make they did not appeal to their own intentions in writing. A majority of the older students, on the other hand, gave indications of having devoted prior attention to the main point of what they had written. They could accurately judge the validity of different expressions of their main point and they made at least some appeal to their prior intentions in defending their judgments.

The present studies are thus supportive of the knowledge-telling and knowledge-transforming models and suggest that they provide a promising starting point for a fuller explanation of expert and novice writing processes. This conclusion can only be evaluated, of course, against some putative alternative. The most likely alternative, we suppose, would be a unitary model of composing, which specifies expert procedures (perhaps including those we identified in Study 1) and which characterizes novice composing by its lack of or deviation from those expert procedures.[1]

In simplest terms, a unitary model would imply that experts and novices are trying to do the same thing but that novices have inferior procedures. What we have proposed instead, again in simplest terms, is that novices are not trying to do the same things that experts are, but that they nevertheless achieve many of the same results. In order to explain how this is possible, a different model must be constructed, which shows how such text characteristics as coherence, organization, and topical relevance can be achieved without the goal-directed activity shown by experts. As regards the findings of the present studies, there is no problem in finding alternative explanations for the deficiencies shown by the less advanced writers—for their very low frequency of constructive moves, for their difficulties in discriminating their own main points, and for their lack of reference to prior intentions. What is problematic within a unitary conception of the composing process is to explain how, in spite of these deficiencies, students manage to produce compositions with identifiable main points.

It is perhaps worth reiterating that the sharp distinctions we have been drawing are between idealized *models* of writing and not between groups of real people. No one could expect subject samples selected according to a crude criterion such as age

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[1] General models of the composing process, such as that of Hayes and Flower (1980), do not constitute such an alternative because they can accommodate a variety of qualitatively different specific models. Both the knowledge-telling and the knowledge-transforming models could be accommodated as variants. In fact, the knowledge-telling model closely resembles Hayes and Flower's model of the generating process (1980, pp. 12–14).

to differ in an all-or-none fashion. Further-more, evidence already exists that under facilitating conditions children begin to ex-hibit problem-solving activity of a knowl-edge-transforming kind (Graves, 1983; Scardamalia & Bereiter, 1985). There is also evidence that with instructional help children can begin to adopt knowledge-transforming procedures while still largely adhering to a knowledge-telling approach, which suggests that intermediate states are possible (Scardamalia, Bereiter, & Stein-bach, 1984). The issue, therefore, is whether the two models are helpful in un-derstanding expert–novice differences in writing, not whether they provide appro-priate categories for sorting people.

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