

Synthesising information from various texts: A study of procedures and products at different educational levels

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The production of written syntheses, which requires reading various sources and integrating information from these sources into one's own text, has been characterised as a potentially useful task for promoting constructive learning. This article describes research aimed at examining and characterising written syntheses and the processes involved in producing them.

A case study was carried out of 45 students from four different educational levels (ranging from secondary school to university) performing synthesis tasks set by their teachers. An analysis was made of the synthesis tasks set and the syntheses produced, the prototypical procedures carried out at each educational level, and the quality of the written products.

The results corroborate the view that producing syntheses is difficult even for university students with a high degree of reading and writing competence. They also show that the difficulty level of the texts and tasks set by the teachers is generally high and that this difficulty increases as students go up the educational ladder. It was found that the younger students adopted more sequential procedures, whereas more experienced students employed more recursive approaches. It was concluded that there is a need to teach students the epistemic uses of reading and writing.

Introduction

Many academic tasks may be regarded as “hybrid” in that they require the production of a new text based on reading one or more source texts (Spivey, 1997); this is the case of elaborating a summary or various tasks that have in common that they require students to take

into account information from various documents in order to create a new product (writing an essay, making a synthesis, etc.). Some research supports the hypothesis that when reading and writing are used together they are more powerful learning tools than when employed separately (for a review see Tierney & Shanahan, 1996; Tynjälä, 2001). In performing such tasks, students alternate between different roles (source-reader, note-writer, new text-writer and new text- or draft-reader). In adopting these changing roles, students become involved in an “internal collaboration” or “dialectic” with themselves (Tierney, O’Flahavan, & McGinley, 1989), which explains these tasks’ potential for promoting learning.

Synthesising information from various texts is a hybrid reading and writing task (Bracewell, Frederiksen, & Frederiksen, 1982; Spivey, 1997). According to Spivey (1997), composing a text on the basis of reading various different sources involves three types of processes: organising, selecting and connecting. During the organising process, readers search the texts for the keys for determining how the ideas are organised. During writing, they create their own structure to organise the contents of the different texts and generate new categories of ideas in order to group the contents together. During the selection process, readers determine the level of importance of the different contents of the sources and include in their own composition the ones they consider most significant in accordance with various relevance and importance criteria (textual, intertextual, rhetorical, personal). During the connecting process, they integrate the contents from the different sources with their prior knowledge, which may lead to a more or less substantial transformation of the contents.

Although synthesis tasks have not been studied to any great extent, research which has examined them (Flower, Stein, Ackerman, Kantz, McCormick, & Peck, 1990; Segev-Miller, 2004; Spivey, 1997) has characterised them as cognitively demanding. Making a synthesis of multiple texts is cognitively more demanding than writing a summary of a single text – one of the commonest hybrid tasks in schools. Preparing a summary also involves generating a new text by selecting, organising, and connecting contents from the source text (Spivey, 1997), but it is possible to keep the same organisational pattern as that employed in the original text, thus producing a reduced isomorphic version of the text. Synthesising several texts, however, requires elaborating an integrative idea or “*superproposition* from different macro propositions of multiple textual sources” (Segev-Miller, 2004), and taking decisions about the organisational structure to adopt in order to integrate the information from the different sources (Flower, 1990; McGinley, 1992; Spivey, 1997). As such, producing a synthesis of multiple texts requires knowledge-transforming to a greater extent than making an isomorphic summary of a single source, which makes it a powerful aid to constructive learning.

Summarising and synthesising not only differ with regard to their degree of complexity, but also to the extent to which students are familiar with such tasks. In a study on the use of learning tasks involving reading and writing in social and natural sciences carried out in Spain with both secondary school teachers and students (12- to 18-year-olds) and university teachers and students (Solé, Mateos, Miras, Martín, Castells, Cuevas, & Gràcia, 2005), we found that producing written syntheses of several source texts is one of the tasks that teachers say they set and students say they perform the least (18.2% and 32.5%, respectively, as against 50% and 64% in the case of summaries). Nevertheless, it is performed to a greater extent the higher one goes up the educational ladder (especially at university). Indeed, it is regarded by teachers as one of the most difficult tasks, but one that is particularly suitable for deepening knowledge. These findings suggest that teachers recognise the potential of synthesis for generating new knowledge and helping students to learn autonomously. However, probably because of the difficulty involved, it is a task that is seldom set and performed, and about which little is known in its actual context.

Previous research indicated that performing synthesis tasks proved too demanding not only for secondary school students (Spivey & King, 1989), but also for most college students (Flower et al., 1990; McGinley, 1992; Segev-Miller, 2004; Spivey, 1984). The work done by Spivey (1997), for example, shows that students do not usually employ their prior knowledge to process information to any great extent, except in so far as is necessary to establish connections and organise contents. Younger students find it particularly hard to establish both

intratextual and intertextual connections. They tend to take ideas from the different texts without providing the necessary links between them. In all cases, the more experienced students are better at selecting information and write more coherent and better-connected texts.

Research carried out so far has also brought to light a number of individual and situational factors that may influence a student's ability to synthesise information.

Some studies have shown that students' ability to synthesise information from several texts increases with their level of reading comprehension (Risemberg, 1996; Spivey, 1984; Spivey & King, 1989).

The organisation of the information within and between texts plays an important role in this process. Nash, Schumacher, and Carlson (1993) demonstrated the influence exerted by the characteristics of the language in the source texts on written syntheses. University students were asked to read two descriptive texts and then write a text with a comparative structure. The source texts had the same or different structures. The results showed that students were influenced by the structure of the first text they read and that their syntheses were better organised when the sources had the same structure than when they had different structures.

When information from documents is synthesised, the specific demands of the task or the instructions given may also vary. Asking students to write an "informative" essay may lead them to make a collection of the most important or most frequent ideas in the source texts, whereas asking them to write a "comparative" essay may induce them to focus on the similarities and differences between their contents. Spivey (1997) has studied the transformations (selecting, organising and connecting) made by students, mainly undergraduates, when tackling different synthesis tasks (writing a report, preparing a research project) on the basis of the same source texts, and when tackling synthesis tasks requiring them to produce a text having either the same structure as, or a different structure from, the source texts (e.g., producing a collection or a comparison on the basis of texts with a collection structure). In fact, making a synthesis of several texts may result in different types of text, such as arguments, reports, projects on a single topic, critical essays and theoretical reviews.

Representing a reading-to-write task to oneself is, in itself, a critical part of the writing process (Flower, 1990). Some representations make the task easier, and some lead to a more critical engagement with the source texts. In the study of university students by Flower et al. (1990), some of the subjects represented the synthesis task to themselves as a summary. They therefore tended to use the strategy of extracting the main points of each text, summarising them and then organising their own text around the principal ideas they had extracted. However, they did not generate an idea or concept enabling them to integrate the ideas drawn from each of the different source texts.

The pattern of reading and writing followed during a synthesis task also translates into products of differing quality. McGinley (1992) found that when making a synthesis of various sources, university students read and write both linearly and recursively. For example, reading appears as a linear activity in that it features to a greater extent during the earlier than the later stages of the process, but it is also used recursively in that it still features to some extent in every stage. Once the students started to write they tended continually to seek support by reading the source texts, their notes and their own texts.

Middle school students, on the other hand, do not usually read and write recursively when performing synthesis tasks on the basis of various texts. Lenski and Johns (1997) carried out a case study of middle school students doing a school research task which involved reading various texts. In this type of task students have to integrate three complex processes: searching, reading and writing. Depending on the order in which the students performed these processes, Lenski and Johns distinguished three profiles or patterns: sequential, spiral and recursive. With the exception of one student who adopted a recursive pattern and wrote a more integrating paper, all the others adopted sequential or spiral patterns and wrote summary papers. In short, the texts that students write may be a restatement of the sources they have read or the students may simply paraphrase the source texts into their own words.

As argued above, asking students to produce a synthesis may in fact conceal different requirements: sometimes it is a matter of complementing, other times of comparing, information

from two or more texts whose superstructure, difficulty and familiarity to the students may differ to varying degrees. Generally speaking, research into students' ability to synthesise employs *ad hoc* situations in which the researchers control a large part of the variables (tasks, texts, etc.). Participants are usually university students who are often taking academic writing courses. Studies carried out in a natural context with non-university students are far less common.

In the context of a broader research project, we set out to investigate the procedures used by students at different levels of the educational ladder to produce written syntheses when asked to do so by their teachers as part of their normal school work. In particular we sought to:

- 1) Determine the characteristics of the syntheses set by social sciences teachers in natural settings.
- 2) Characterise the written products generated by the students.
- 3) Identify the procedures employed by students at various different educational levels in making a written synthesis.

We expected that the difficulty of the synthesis tasks set by the teachers and the complexity of the texts on which they were based would both gradually increase the higher one went up the educational ladder.

We expected that the products created by the younger students, who could be assumed to have less experience in performing this type of task, would be characterised by the absence of an integrating theme that would enable them to organise the contents taken from the different texts. In particular, we expected that students at the lower levels would produce juxtaposed summaries of the different texts or lists of disconnected ideas from the various texts, rather than written syntheses as such.

We expected to find a relationship between the quality of the products and the complexity of the procedures employed in creating them. We expected that the products coming closest to successful syntheses would be associated with a recursive process involving recurrent global reading; writing mediated by notes, outlines and rough drafts; and revision of the student's own text without losing sight of the source texts. Correlatively, we expected that the products furthest removed from successful syntheses would be associated with a sequential process involving fragmented reading, direct writing and scant revision.

Method

Participants

45 students (21 male and 24 female) at state-run secondary schools in Barcelona and Madrid, and at the Autonomous University of Madrid, Spain. The composition of the research sample was as follows: 12 first-year ESO (12-13 year-old), 11 third-year ESO (14-15 year-old) and 11 Bachillerato (16-17 year-old) students, and 11 university students taking Psychology. All the students at each level belonged to the same class.

The participants included students with high and low reading and writing competence, as determined by a test (González Nieto, 2002), and high and low performance in social sciences subjects, as determined by their grades on these subjects.

Design and procedure

We carried out a qualitative case study of 45 secondary school and university students. Students had to produce a written synthesis based on reading two texts. At all four educational levels the tasks formed part of a normal teaching sequence. Texts were chosen by the teachers and task instructions were given by the teacher to the whole class. The participants performed

the task outside of the classroom in the presence of a researcher, whereas their classmates did the task at home. The entire proceedings, during which think-aloud protocols were obtained, were videotaped and subsequently analysed using a category scheme based on previous research findings (Coté, Goldman, & Saul, 1998; McGinley, 1992).

Data analysis procedures

The analyses whose findings are reported in this article are as follows:

- a) The characteristics of the tasks and the source texts for each of the four levels. This analysis is necessary in order to contextualise the findings.
- b) The quality of the products, based on analysis guidelines.
- c) The procedures employed by the different students to produce their syntheses.

Tasks and texts. The following factors were taken into account in order to characterise the tasks and texts:

- The type of general relationship to be established between the texts required by the synthesis: complementing/comparing; and the specific relationship: chronological sequence, connecting causes and consequences, comparing arguments.
- The documentary source: textbook, newspaper article, scientific text, etc.; and its nature: original or adapted by the teacher.
- The superstructure or rhetorical structure of the texts: narrative, expository, argumentative, etc.
- The students' degree of familiarity with the contents, based on their knowledge of the topic as previously determined by means of a set of written questions.
- The difficulty of the texts, as rated by two judges on a four-point scale (low, medium-low, medium-high, high), on the basis of their vocabulary (number of technical terms), information density (number of concepts or ideas) and their degree of coherence and cohesion. Interjudge agreement was 88%. Disagreements were resolved by discussion.
- In order to complete the characterisation, the degree to which the teacher concretised the instructions given to the students in regard to the task was also analysed.

The products. The written syntheses produced by the students at the different educational levels of the texts characterised above were analysed¹ along four dimensions:

- Integration and connection of the information from both texts around a structuring theme.
- Selection of ideas necessary for producing the synthesis.
- Appropriateness of the interpretation, as measured by the presence/absence of incorrect content.
- The degree to which the contents were elaborated: copying, paraphrasing, introduction of new terms.

By applying these dimensions, we were able to establish different types of products, as seen in Table 1.

Procedures used in performing the task and their relation to the finished products. In our research we collected data on the task performance processes set in train by the students. Analysis of these data provided access to the different reading and writing tasks performed by the students in order to produce a synthesis and the sequence in which these tasks were performed. This analysis was carried out on the basis of viewing the recordings made of the students while performing these tasks, and also taking into account the products generated.

The categories used to describe the patterns are as follows:

- Reading source text 1(ST1) and source text 2 (ST2)
- Reading and underlining ST1 and ST2
- Reading part of ST1 and ST2
- Reading written notes
- Reading draft
- Reading the text produced
- Writing notes
- Writing outlines
- Writing draft
- Writing the text
- Revising

Table 1

Types of synthesis and their characteristics

Type of synthesis	Characteristics
1. Non-synthesis /poor comprehension	<i>Comprehension difficulties. Structurally it is not a synthesis</i> These products present serious problems regarding comprehension of the source text and structurally they are not syntheses
2. Non-synthesis	<i>Correct comprehension. Structurally it is not a synthesis: List of ideas, juxtaposition of summaries</i> Comprehension of the source text does not seem an issue, but the products are not syntheses. There is no explicit structuring theme
3. Attempted synthesis/poor comprehension	<i>Incorrect or under-elaborated structuring theme. Incorrect interpretations</i> Failed syntheses because they lack an adequate structuring theme. Texts that contain errors of comprehension
4. Attempted synthesis	<i>Incorrect or under-elaborated structuring theme. Correct comprehension</i> Failed syntheses because they lack an adequate structuring theme
5. Successful synthesis	<i>Correct structuring theme. Integration of information from both texts. Correct comprehension</i>

Ascertaining which of the above procedures are employed and the sequence in which they are employed makes it possible to reveal the existence of performance patterns with a greater or lesser degree of recursiveness and mediation between the source texts and the production of the students' own texts. Performance procedures can be identified that follow a sequential logic (the student reads first, then writes) or a recursive logic (the student reads, writes, re-reads, writes again and reads again). Moreover, the procedures vary depending on the mediation introduced. In some cases mediation is practically non-existent (the student reads the ST and writes their own text directly), whereas in others various degrees of mediation are found (reading accompanied by underlining and/or note-taking; making of outlines and/or rough drafts; revision and amending of the student's own text). The procedures were classified into three levels of complexity depending on their degree of recursiveness and mediation:

- (1) low complexity: the students read the texts and at most underline parts of them; they write directly without looking at the source texts or look at parts of one or both sources but do not revise the text they have produced;
- (2) medium complexity: the students read the texts and at most underline parts of them; they look at parts of both sources as they write, revise the text they have produced and may make changes to it, albeit only formal ones.

- (3) high complexity: the students read the texts, take notes or make outlines and rough drafts; they look at the sources, their notes, outlines or rough drafts as they write and revise the text they have produced, changing both its form and content.

Due to the small number of participants at each educational level, in many cases the observed frequency in each procedure or product category was less than five. It was therefore not considered appropriate to apply statistical tests and only a descriptive analysis was carried out without any intention of generalising the results beyond the sample studied.

Results

Applying the analysis procedures and instruments described above to the data obtained in regard to each of the aims has generated a series of findings which are discussed below.

Characteristics of the syntheses set by social sciences teachers in natural settings at different educational levels

As summarised in Table 2, characterisation of the synthesis tasks and texts brings out numerous differences among the situations confronted by students at each of the levels.

Table 2

Characteristics of the synthesis tasks set by social sciences teachers in natural settings at different educational levels

Level	First-year ESO	Third-year ESO	Bachillerato	University
Topic of synthesis	Perception of the earth and cartography	Immigration in Spain	Social change	Theories of learning
Type of synthesis	Complementing Producing a chronological sequence	Complementing Marshalling arguments	Complementing Connecting causes/consequences	Comparing Contrasting points of view and arguing
Type of source texts	Texts based on the textbook	Texts adapted from non-academic texts	Texts taken from text books	Authentic scientific texts
Superstructure	ST1, ST2: Expositive/chronological sequence	ST1 Expositive/descriptive ST2 Argumentative	ST1. Expositive descriptive ST2 Expositive comparative	ST1, ST2 Argumentative
Familiarity with topic	Medium-low and low	Medium	Medium-high and high	Low
Difficulty	Medium-low	Medium-high	High	High
Instruction	Concrete and explicit. Mentions the integrating theme	Generic. Does not mention the integrating theme	Concrete and explicit. Mentions the integrating theme	Generic. Does not mention the integrating theme

The vocabulary of the texts used with the first-year ESO students is suitable to their level, even though it contains certain technical terms. The texts are coherent and they both have an obvious chronological structure, one dealing with the evolution of knowledge about the shape of the earth, the other with the evolution of map-making. The topic does not appear to be very familiar to the students, in spite of the fact that a teaching unit on the subject was being presented to them at that time (two-thirds had a medium-low, and one third a low degree of familiarity with it). The texts were adapted by their teacher from textbooks. In regard to the synthesis required, the two texts displayed a complementary relationship, with numerous, visible indicators allowing the students to connect the contents of the two texts. The

instructions explicitly stated the relationship between the texts and what was expected of the students (“bring the facts together...”).

In third-year ESO the synthesis was set by the social sciences teacher as just another activity within a teaching unit on population and, more specifically, on the topic of immigration. The texts used with the third-year ESO students were adapted by their teacher from non-academic texts (a newspaper article and a report). The vocabulary was suitable to their level, but the text structures were different. One of the texts provided data on the growth of immigration in Spain and described the economic benefits of this phenomenon for the country. The other argued against the negative and simplistic view many people have of immigration. The students seemed to be familiar with the topic, but in most cases their prior knowledge was essentially similar to this simplistic view of the subject. The relationship between the two texts was complementary, but the integrating theme was not obvious, although it could be deduced from one of them. The task instructions did not explicitly state the relationship between the texts; only the requirements of the task were made explicit (“integrate the information from both texts, either because it is complementary or because it is not”).

The texts given to the Bachillerato students, one descriptive the other comparative, were adapted by their teacher from textbooks and contained difficult vocabulary. They introduced numerous technical terms that either were not explained or were defined in an unclear way, and both lacked coherence and cohesion mechanisms. The topic appeared to be familiar to the students (two-thirds had a medium-high, and one third a high degree of familiarity with it) and they had studied “social conflict” in previous sessions. The relationship between the texts, which were also complementary, was one of “cause and consequence”. This relationship was visible, but hard to identify due to the texts’ intrinsic complexity. The instructions explicitly stated the relationship between the two texts (“one talks about causes, the other about consequences...”) and what the students were expected to do.

At undergraduate level the synthesis task was presented as a practical activity in dealing with a topic in the History of Psychology. The texts given to the university students by the lecturer were authentic scientific texts written by classic researchers in the psychology of learning field. Both used technical terms and put forward empirical arguments to support their theories. The students’ prior knowledge of the topics dealt with in the texts (learning by association and learning by insight) was fairly limited. The texts presented different opinions on the same subject, so the relationship between them was one of contrast. The instructions did not explicitly mention the relationship between the texts, nor what was expected of the students. They were simply asked to produce a synthesis of the two texts.

In general, the following differences were found:

- At the lower levels, the students were required to complete information from academic and non-academic texts adapted by the teachers. At university, students were required to compare the viewpoints of two authors as expressed in authentic scientific texts.
- Whereas the predominant superstructure at the first three levels was expositive in various ways, university students were faced with texts arguing for a particular point of view.
- The least difficult texts were those given to students at the lowest level (first-year ESO), while the lexical and syntactical difficulty of the texts became progressively greater, the higher the educational level.
- The texts given to university students had two features which increased their complexity: a high degree of difficulty and limited topic familiarity.
- The instructions given to first-year ESO and Bachillerato students were more explicit than those given to third-year ESO and university students.

This analysis suggests that the situations designed by teachers were rather complex. It also suggests that as one goes up the educational ladder, the complexity increases with regard to the type of synthesis required, the documentary sources used, the superstructure and the difficulty of the texts. At the highest level – university – the greater complexity of the task is combined with more generic task instructions.

The written products created by the students

The written syntheses produced by the students at each of the educational levels were analysed along the dimensions described above. The five types of written product are distributed differently at the different educational levels, as shown in Figure 1.

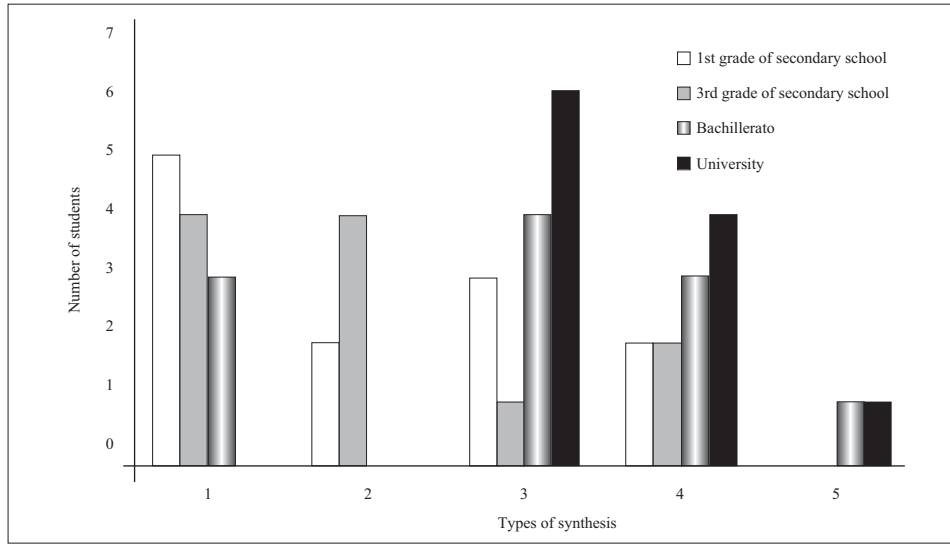


Figure 1. Types of synthesis at the different educational levels

Due to the small number of participants, the five types of synthesis were grouped into three types of product according to their quality:

- 1) the low quality products included the non-syntheses with comprehension problems;
- 2) the medium quality products included the non-syntheses without comprehension problems and the attempted syntheses with comprehension problems;
- 3) the high quality products included both the attempted syntheses without comprehension problems and the successful syntheses.

The products of low quality constituted 26.7% of the total, those of medium quality 44.4% and those of high quality 28.9%.

- There is a progression as one goes up the different educational levels: The higher one goes, the fewer products characterised as “non-synthesis” are found, until they disappear altogether. As can be seen from Figure 2, the low quality products represented 41.7% of all the products by first-year ESO students, 36.6% of those by third-year ESO students, 27.3% of those by Bachillerato students and none of those by university students. Correlatively, the number of “synthesis” products, including attempted syntheses, as well as successful syntheses, increases, accounting for 16.7% in first-year ESO, 18.2% in third-year ESO, 36.4% in Bachillerato and 45.5% at university.
- A large proportion of the students (57.7%) – those who produced non-syntheses/poor comprehension (12 students) and those who produced incorrect attempted syntheses (14 students) – present misinterpretations and comprehension difficulties with regard to the source texts. At all except one of the levels (third-year ESO), at least 50% of the cases studied presented such difficulties.
- In only two cases was it possible to speak of successful syntheses.

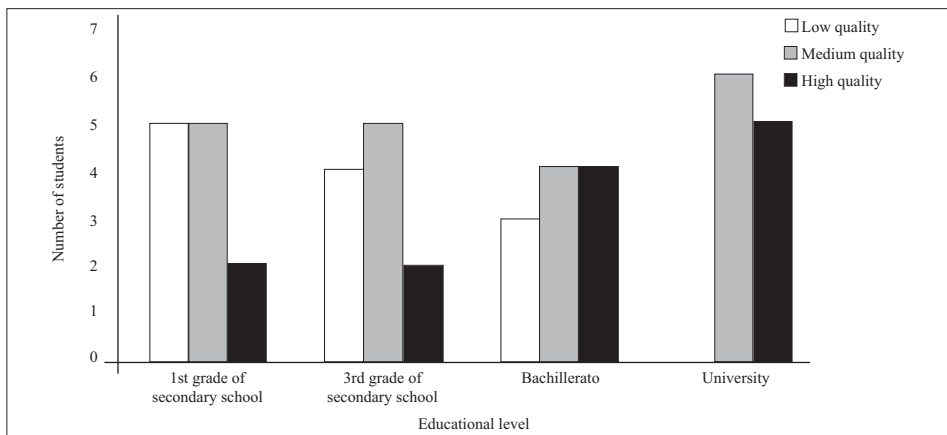


Figure 2. Assessed quality of products at the different educational levels

The procedures employed by students at various different educational levels in producing a written synthesis

Out of the whole sample, 35.6% of the students employed low complexity procedures, 31.1% employed intermediate complexity procedures and 33% employed high complexity procedures. Our analysis reveals differences among the most representative procedures at each of the educational levels, as shown in Figure 3. These procedures become more and more complex and adequate to the task the nearer one gets to university level.

Low complexity procedures are the most frequent among ESO students, although their frequency declines between the first and third years, being used by 75% of first-year students and 63.6% of third-year students. Students at the higher educational levels – Bachillerato and university – no longer use these procedures. In contrast, high complexity procedures were employed by only one ESO student, while their use increased between Bachillerato and university from 54.5% to 72.7%. The use of procedures of intermediate complexity increased between first-year ESO and Bachillerato, being employed by 16.7% of first-year ESO students, 36.4% of third-year ESO students and 45.5% of Bachillerato students.

The prototypical or most frequent procedures at each educational level are summarised here below.

Prototypical first-year ESO procedure:

Reading and underlining	Textualisation: Copying what has been underlined
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Prototypical third-year ESO procedure:

Reading	Textualisation: Referring to source texts
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Prototypical Bachillerato procedure:

Reading, underlining and note-taking	Writing a rough draft, referring to notes and source texts	Textualisation: Making a fair copy of the rough draft	Revision of formal aspects
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Prototypical university procedure:

Reading, underlining and note-taking	Writing an outline or rough draft, referring to notes and source texts	Textualisation: Referring to outline and source texts	Revision of formal aspects and contents
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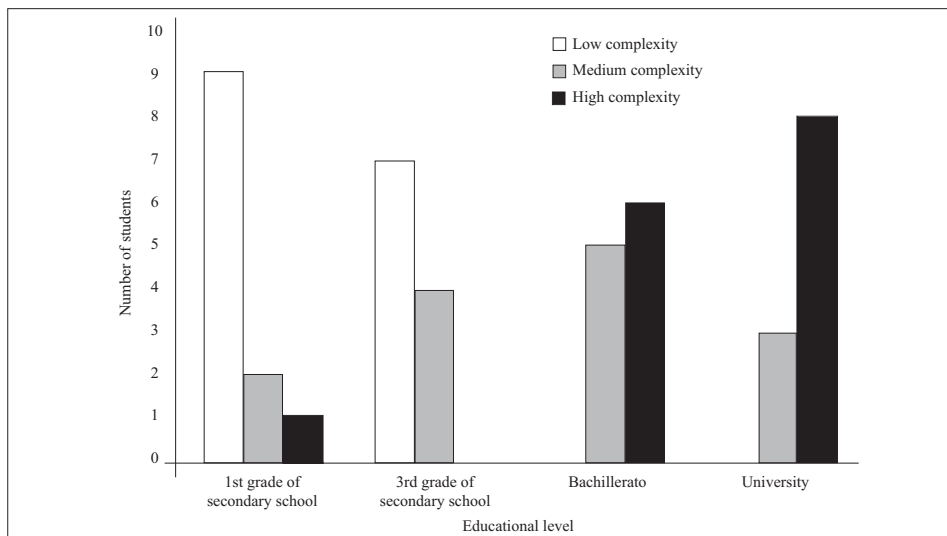


Figure 3. Level of complexity of the procedures at the different educational levels

As can be seen, whereas at the lower educational levels the procedure is simple and practically direct (reading and underlining – writing/copying), as the educational level increases elements appear indicating a greater degree of mediation between the source texts and the text produced by the student (reading while taking notes, writing with outlines and rough drafts) and an increasingly greater use of revision, which is absent from the production processes of the younger students. Another typical feature of the procedure at the more advanced levels is that students take the source texts into account at every stage of their production, in what appears to be a recursive process. The youngest students (first-year ESO) read the texts and “forget” about them, adopting a more sequential approach.

Relationship between the procedures followed and the products generated within each level

As shown in Figure 4, 75% of the low quality products in the sample as a whole are associated with the use of low complexity procedures, whereas none of the high quality products is linked with low complexity procedures. Moreover, the use of intermediate and high complexity procedures is associated with intermediate and high quality products to a greater extent than with low quality products.

Nevertheless, the data on the differences between the procedures used by the students who produced the best and worst syntheses at each of the educational levels are not conclusive.

At the lower educational levels there is a positive relationship between the degree of complexity of the procedure employed and the quality of the product generated. As can be seen from Figure 5, all the syntheses in first- and third-year ESO that were classified as products of low quality and a large proportion of the products of intermediate quality (80% in first-year ESO and 40% in third-year ESO) were generated by students who employed low complexity procedures. The remainder of the intermediate quality products (20% in first-year ESO and 60% in third-year ESO) were generated by students who employed procedures of intermediate complexity. Intermediate complexity procedures were also used by a large proportion of the students who generated high quality products (50% in first-year ESO and 100% in third-year ESO). The other 50% of high quality products were generated by first-year ESO students using high complexity procedures.

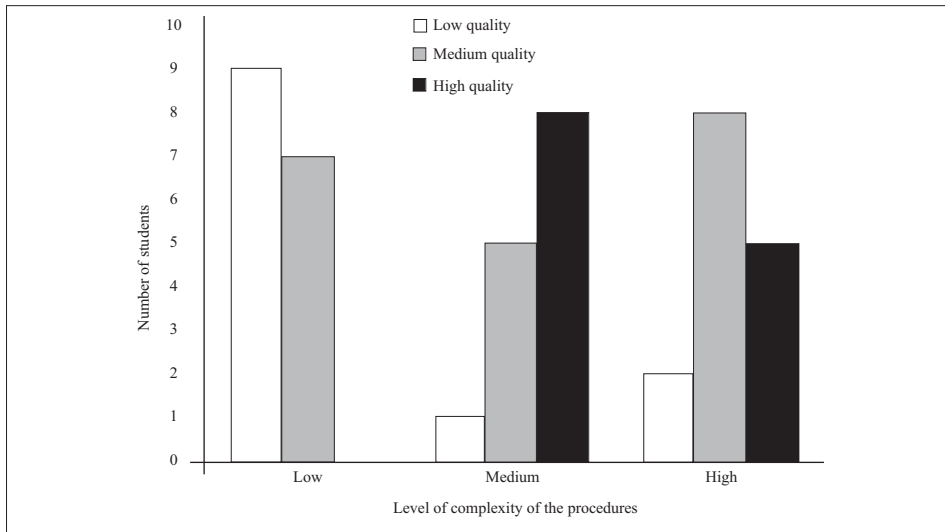


Figure 4. Relationship between the procedures and products of the whole sample

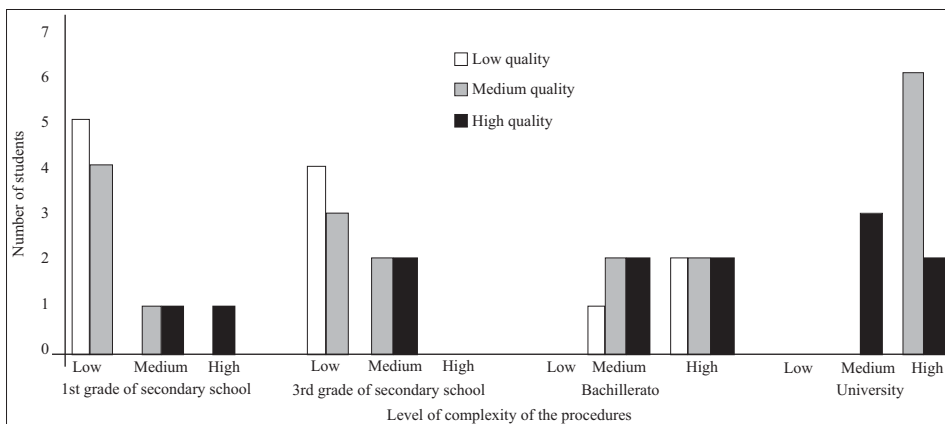


Figure 5. Relationship between the procedures and the products at the different educational levels

However, a similar relation between the complexity of the procedure employed (medium or high in all cases and therefore, it might be supposed, potentially adequate) and the quality of the product (medium or high) was not found among the Bachillerato or university students. The only relevant finding was that the students who did not make any content changes to their texts, even though they reread them once they had finished writing, produced some of the worst products.

In short, although we found a certain correspondence between the most adequate procedures and the best products, this relationship did not hold in all the cases studied.

Discussion and conclusions

In this qualitative study, we aimed to investigate the written products and the reading and writing procedures used by students in their normal school work. Our first aim was to

determine the characteristics of the syntheses set by teachers at different educational levels. Our results allowed us to identify the tasks and texts proposed at each level as well as the significant differences found between them.

Our first hypothesis, according to which we expected the difficulty of the synthesis texts and tasks to increase the higher up the educational ladder one went, has been confirmed. Moreover, we may add that as far as the texts and tasks in this study are concerned, the teachers had considerable difficulty in finding texts that would facilitate elaborating a synthesis and in providing the students with an aim that would require them to integrate the information from both texts. In many cases the instructions given to the students did not go beyond asking them to connect or integrate the ideas in the different sources.

Our results confirm the influence of the synthesis task instructions on the selection, organisation and connection processes as found by Spivey (1997). In this regard, it is noteworthy that only at undergraduate level were the students required to produce an argumentative text – the kind of task whose potential for knowledge-processing and learning appears to be most clearly established (Wiley & Voss, 1999).

The results obtained have allowed us to meet our second aim; to characterise the written products generated by students. Taking into account four dimensions (integration, selection, appropriateness of the interpretation and content elaboration), we were able to identify qualitative differences between texts produced by students in the course of this research project.

As expected in accordance with our second hypothesis, the quality of the products differed from one educational level to another, with the students at the lower levels creating the products the furthest removed from synthesis. The texts produced by these students are often juxtaposed summaries of the source documents and fail to integrate the information. Only at the higher levels – where we found the only two successful syntheses – did the attempted syntheses outnumber the products that cannot be considered syntheses. Our data confirm the difficulty posed by the task of producing a synthesis (Flower et al., 1990; McGinley, 1992; Segev-Miller, 2004; Spivey, 1984). In spite of the progression observed – and expected – as one proceeds up the different educational levels, successful syntheses, even at the higher levels, make up an extremely small proportion of all the products analysed.

This difficulty in making syntheses derives, at least in part, from the way the students represent the task to themselves. Corroborating Flower's (1990) findings, a large number of the participants in our study conceived synthesis as a summary organised around the main ideas drawn from each of the source documents. Only a very small minority referred to the need to find an integrating idea or concept² (and its effective presence).

Moreover, analysis of the products themselves shows that many students (more than 50% of the total) misinterpreted fragments of the source texts – 12 of them, in fact, had difficulty in understanding the texts as a whole – even at the higher educational levels. Previous research (Risemberg, 1996; Spivey, 1984; Spivey and King, 1989) has shown that competence in making syntheses increases with the level of reading comprehension, which might – in part – explain our findings. However, it should not be forgotten that even though nearly half the texts produced displayed no comprehension difficulties, these too failed to synthesise the source documents adequately. Exploring more specifically the complex relations between text comprehension and synthesis production is a promising line of research for improving our knowledge of these processes.

The third objective of our study was to identify the procedures used by students to make syntheses. Taking into account the degree of mediation and recursiveness of the procedures, we were able to identify low, medium and high complexity patterns of performance. As was to be expected according to our third hypothesis, the procedures employed by students at the higher levels of the educational system were more complex and appropriate than those employed by students at the lower levels, whose procedures were simpler and more direct. These results corroborate the findings of McGinley (1992) with university students and those of Lenski and Johns (1997) with middle school students. Whereas the former became involved in more recursive performance patterns in which writing was supported by recurrent reading of the source texts and their own notes, in Lenski and Johns' study the most common

performance pattern was linear or sequential, as it was in the case of our younger participants. Overall, then, there appears to be a relationship between more complex performance patterns and better products, which are more common among university students. These students alternately and recurrently adopt the roles of reader and writer characteristic of a dialectic process “with himself or herself” (Tierney, O’Flahavan, & McGinley, 1989). In general terms, although our data revealed a correspondence between the degree of sophistication of the procedures employed and the quality of the products, this correspondence was not perfect. This may be due to the fact that at the higher educational levels the students no longer use simple procedures, which means that the differing qualities of their texts are the product of similar procedures (of medium and high complexity). At the lower levels, where the students are just beginning to tackle synthesis tasks, extremely simple procedures co-exist with more complex ones and a relation between procedure and product is more frequently found.

Another feature of the relation between the procedure employed in performing the task and the quality of the resulting products which our study has brought out is the importance of the students’ revision of their own texts, not only in regard to formal aspects, but also in regard to content. Even though they may use procedures of a certain complexity, students who carry out a purely formal revision produce products of poor quality. This finding, which corroborates those of other researchers (Flower et al., 1990), deserves further investigation. In this sense, it would be useful to employ a more controlled design to look at the effect of the differentiated use of mediation, recursiveness and revision on the quality of synthesis products. This finding also suggests the need to pay more attention to the teaching of revision strategies.

On the whole, our study corroborates what has already been found by previous research (Segev-Miller, 2004) on the cognitive demands posed by this task and the need to teach it adequately. In spite of the fact that 50% of the participants in this study had a high level of reading and writing competence, they were unable to produce a written synthesis. We can infer from our data that this is a task that is seldom performed and that few instructions are given when it is set. This interpretation is backed up by the procedures employed by the students, especially secondary school students. These procedures seem to reveal a recently learned sequence (somewhat different in each case), which most of the students apply in a fairly mechanical fashion (as happens in many cases when they revise their product). In such conditions, it looks as though, rather than using strategic thinking to resolve a *problem* requiring the integration of diverse pieces of information around a structuring theme, the students engage in the *exercise* of “joining, connecting, etc.” as an end in itself, without an adequate representation of what the task really requires. Learning to do this requires strategic, informed teaching (Bruer, 1993) and paying attention not just to the instrumental, but also the epistemic use of reading and writing.

The results presented here, and the conclusions that can be drawn from them, should be interpreted with caution due to the nature of the research carried out. Since our aim was to observe and describe how students at different educational levels perform written synthesis tasks based on multiple sources in natural academic contexts, we decided not to exercise any control over the variables that might influence the execution of the tasks. The fact that both the texts and the type of synthesis were chosen by the students’ own teachers had several consequences. On the one hand, it generated variability in the data-gathering situations, which makes comparisons between levels difficult. That is why, although we have described the differences observed between the groups at the different educational levels, our study does not allow us to explain to which variable (educational level, type of text, type of synthesis task, etc.), or which combination of variables, these differences are due. On the other hand, the design used ensured that the task set made sense within the general dynamics of the class and that the degree of difficulty of the task was regarded by the teachers as being within their students’ capabilities.

Research which exerts a more exhaustive control over the situation and its variables frequently fails to take such conditions into account. Our research also calls into question approaches that focus exclusively on analysing the products created by the students and approaches that fail to take into account the context in which they are produced. As we have

seen, what on the face of it is the same task may in fact require students to establish very different relations (comparing, complementing). Texts which have the same (expository) structure may in fact be of very different kinds. The instructions given by the teachers may also differ widely. In this study we opted to carry out a detailed analysis of the tasks faced by students at different educational levels, the procedures they employed and the written products they generated. To do this, we selected a small number of students at each level at the expense of being able to generalise the results.

In conclusion, our study, in spite of its limitations, points to the potential of the contextualised qualitative research perspective for understanding the processes leading to the elaboration of knowledge through texts. Many of the variables identified as influential by other studies showed up in our research as well; at the same time, our approach suggests the need to study in a more controlled manner the impact of other variables which in a natural setting appear to be influential (such as the task instructions, or the characteristics of the source texts). Advancing in the identification of relations between these variables, the products and the underlying processes is no doubt one of the challenges that must be met.

Notes

- ¹ Mariana Miras, Elena Martín, Marta Gracia, Núria Castells, Ruth Villalón, and Sandra Espino collaborated in the analysis of the written products and the procedures employed by the students.
- ² Our study explored the students' representations of the task set by means of an interview before they actually carried it out. In analysing these representations, we took into account whether the students alluded to the need to find an idea, concept or theme that would allow them to integrate the contents of both texts. The representations were extremely heterogeneous (finding the main ideas, summarising, connecting, etc.). Only at university level did a majority of students allude to the need to compare and connect the ideas of both texts.

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L'élaboration d'un texte de synthèse, qui exige de lire et d'intégrer l'information provenant de diverses sources dans un texte propre, a été caractérisée comme étant une tâche potentiellement adéquate pour promouvoir l'apprentissage constructif. Cet article est la description d'une recherche dont les objectifs prétendaient découvrir et caractériser les productions écrites ainsi que les processus impliqués dans l'élaboration de la synthèse. Pour cette recherche, une étude de cas a été menée sur 45 étudiants de quatre niveaux d'enseignement différents (depuis l'enseignement secondaire jusqu'à l'Université) qui réalisaient des tâches de synthèse proposées par leur professeur. On a analysé les textes ainsi que les tâches de synthèse proposés, les procédures de réalisation prototypiques de chaque niveau d'enseignement, et la qualité des productions écrites. Les résultats corroborent l'idée de la difficulté de la synthèse, y compris pour des étudiants d'université et lorsque la compétence en lecture et en écriture est élevée. Ils montrent parallèlement que la difficulté des tâches et des textes proposés par les professeurs est en général élevée, et que cette difficulté augmente avec le niveau d'enseignement. On observe que les élèves les plus jeunes adoptent des procédures plus séquentielles, alors que les plus expérimentés sont plus récursifs. On conclut par la nécessité d'enseigner aux élèves et étudiants les usages épistémiques de la lecture et de l'écriture.

Key words: Case analysis, Epistemic reading and writing, Higher education, Secondary education, Synthesis.

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