Evaluation Pattern of Cognitive Processes in Language in Written Comprehension

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Abstract—Our research aims at helping the tutor on line to evaluate the student's cognitive processes. The student is a learner in French as a Second Language who studies an on-line socio-cognitive scenario in written communication. In our method, these cognitive processes are defined. For that, the language abilities and learning tasks are associated to cognitive operation. Moreover, the found cognitive processes are named with specific terms. The result was to create an instrumental pattern to question the learner about the cognitive processes used to build an item of written comprehension. Our research follows the principles of the third historical generation of studies on the cognitive activity of the text comprehension. The strength of our instrumental pattern stands in the precision and the logical articulation of the questions to the learner. However, the learner's answers can still be subjective but the precision of the instrument restricts it.

Keywords—Cognitive processes, Evaluation pattern, French as a second language, Socio-cognitive scenario, Written comprehension.

I. INTRODUCTION

MANY studies of the evaluation of the cognitive processes and of the written comprehension exist but nobody has used our pattern which identifies in depth the cognitive processes used to achieve some tasks in written communication. Our method in creating the pattern was a link between the field of the Language Sciences and the field of the Cognitive Sciences. Moreover, the pattern should be experimented on a Moodle platform, the platform SdEFol, of the University of Rome Tre with "Sciences of Education" degree learners at the Waystage level (A2) of the Common European Framework of Reference for Languages (CEFR). With this experiment, our pattern is completed in order to be more pragmatic. Our researches aim to give the on-line tutor an evaluative instrument for his perception activity of the cognitive processes for the communicative competences in a second or a foreign language. Later, digital tasks of communicative competences in language will be created to offer cognitive remediation of learning when the learner needs it. First of all, the structure and the goal of our socio-cognitive scenario are explained to learn French as a Second Language

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and to understand what the place of each written communicative competences is. Afterwards, the evaluation of learning in written communication and in particular, the evaluation of cognitive processes in written comprehension are presented. At the end, the pattern - to evaluate cognitive processes which is created for written comprehension - is showed in order to help the on-line tutor in his perception activity.

II. SOCIO-COGNITIVE SCENARIO

A. Presentation and Structure

Four courses of teaching at level A2 of the CEFR have been included in the socio-cognitive scenario. These thematic courses dealt with the French-speaking communities, cultural events and feast, holiday and leisure, and the discovery of the city. Each course of teaching is divided into two modules except the last course which had only one.

The second course of teaching is taken to describe its structure. The course is named "Culture in feasts". This course begins with an introduction on the subject. With this introduction, a controversial document is offered to help the learner enter the subject of the course and speed up his ideas.

In the first module, the cultural events are studied. This module begins with a task of written global and detailed comprehension on three advertisements of cultural events. From this task of written comprehension, the learner must infer linguistic rules from the indicators of place to speak about a country and from the temporal indicators to speak about an annual period, a date or a day time. Then, the learner is put in position to become more active. The learner must look for three advertisements of cultural events on line in the context of French-speaking communities and must answer the same questions of written comprehension that the ones of the initial task. In the second task, the learner must select the appropriate information from the six worked advertisements and must fill in an electronic calendar with basic data. This was an individual and personal written guided production with a correction done by the on-line tutor.

In the last activity of this module, a collaborative task of written production on a WIKI is offered to a little group of learners. In the first time, the scenario gives information and hypertext links to the group of learners to create the identity of French-speaking person. So the members of the group must

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share out the work and data between them to carry on the task. In the second time, the members of the group are asked to choose a cultural event to fill in a form created by themselves. Examples of forms are given on hypertext links to help the group construct it together and to fill in a form in their own written production.

In the second module, the feasts are studied. From a written document on-line on the French feasts, the learner is asked to select the words or expressions about the months of the year, the temporal indicators, the indicators of place, the verbs at the indicative present in French with their subject and the simple articulators of speech. This task is based on the acquisition and the memorization of vocabulary terms used in the daily life and the aim is to form and to structure the sentences in space and time.

In another collaborative task on a WIKI, the little group of learners must present the principle feasts of a French- speaking country. Then the members of the group must carry out the appropriate researches on line and must share the work to write a little text for each feast by using the vocabulary terms and the linguistic rules of this learning course.

At the end of this learning course, a task of self-evaluation is offered to the learner. This task was a translation of an Italian text in French by still using the vocabulary terms, the linguistic rules and structures of this course. After the translation, the learner must compare his/her production to a model of correction.

The last activity is an evaluation and personal task. Each learner has to look for information in a French-speaking country and present his/her guided production in a Powerpoint file using the linguistic notions seen in the first and second learning courses. The on-line tutor evaluates this individual and personal written production with a specific evaluation schedule. A continuous assessment value is attributed to this personal written production and its result. The last two tasks are at the end of each course. The role of the written comprehension tasks and of the written production tasks in the socio-cognitive scenario are precisely explained in the following two under parts.

B. The role of the Tasks of Written Comprehension

In the socio-cognitive scenario, the tasks of written comprehension had several roles and characteristics.

The introduction of the topic gave the basis of ideas and the vocabulary terms to understand the topic. The learner is immersed in the topic and must identify, parse, memorize and organize the discovered morphemes to form a meaning [1]. It is an autonomous phase for the learner.

The task of written comprehension could aim at having a semantic analysis of a written daily life document. The learner is asked to understand the speech acts and their different meanings (the locutionary meaning, the illocutionary function and the perlocutionary value) [2], to consider the propositional content by doing, according to Frege, presuppositions and inferences for example, and to do an analysis of the thematic structure [3].

The task of written comprehension could have a syntactic analysis as a goal. The Cormon's point of view [1] is adopted here. Cormon took again six comprehension strategies from Clark and Clark's model [4] to adapt them to the mechanisms used to understand a foreign language. Cormon [1] said that the use of the syntactic analysis depends on the learner's personal learning style. Certain learners try to reach the global meaning of an utterance whereas others prefer to identify each element of the utterance. So we help the second style of learners with more guided questions to question themselves on linguistic terms and structures.

The task of written comprehension could aim at making the learner more active. The learner is asked to look for authentic documents and to do research on them to simultaneously reemploy his strategy of comprehension which is the comprehension of morphemes, the syntactic analysis and the semantic analysis.

C. The role of the Tasks of Written Production

As the tasks of written comprehension, the roles and the characteristics of the written production tasks depended on their objectives.

When the task of written production was the following of a written comprehension task, its goal was to encourage the learner to reemploy the morphemes, the linguistic rules and the speed acts viewed before. The aim is to reactivate his/her memory.

For the collaborative task of written production, the learners of a little group are asked to work together. The learners must organize themselves to succeed in the task. They collaborated, shared the work, communicated to exchange ideas, improved their production and corrected each other. They confronted their acquisition and their strategies with others. Therefore it is wise to introduce a thought on the foreign language.

With the task of translation, the learner is helped to think on the architecture of the foreign language and to compare the similarities and the differences between the mother language and the foreign language.

With the personal task of evaluation, the learner's creativity is encouraged and the learner is pushed to excel in reemploying his acquisitions.

III. FROM THE EVALUATION OF THE COMPETENCES TO THE EVALUATION OF THE COGNITIVE PROCESSES

A. To Evaluate the Competences

From the CEFR, the competence of language to communicate is defined by its linguistic, sociolinguistic and pragmatic components. The three components from the defined evaluable competences are provided by Tagliante [5]. The linguistic component includes the lexical, grammatical, semantic, phonologic, orthographic and orthoepic (that is the ability to produce a correct pronunciation and intonation from a written text) competences. The sociolinguistic component takes into account socio-cultural elements as the social relation traces, the polite rules, the idiomatic expressions, the registers

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of language, etc. The pragmatic component includes the discursive competence and the functional competence (ability to identify and to produce utterances lined to language functions).

These three components are used to realize activities of language to treat texts and discourses which topic depends on a personal, public, professional or educational context. These activities of language are the concern of the reception, the production, the interaction and the mediation. To realize these activities of language the learner uses the best strategies to succeed in a given task of learning.

To evaluate the competence of language, it is necessary to link the user's levels to the competences (as to understand, speak and write) and to the time of learning. There are three times of learning: the initial evaluation, the continuing evaluation and the final evaluation.

The initial evaluation is used to take information in order to guide the learner towards a level of competence, to constitute levels groups and to identify the successes and the difficulties of the learner. Generally, an admission test in training is allowed. This test serves the teacher to identify and to analyze the learner's profile and to establish an appropriate program of training. If the test and its results are reviewed with the learner, it enables to know where he/she is situated in his/her own learning, to motivate oneself to pursue the learning and to manage it in autonomy.

The continuing evaluation is used to take information on the learning state of the learner at a given period of the training. The teacher searches to evaluate some objectives of training that the learner may not master at this time. If the learner does not master these objectives, the teacher will adjust his teaching. With full knowledge of the facts, the learner will perform a personal retroaction on his/her learner process. So, this continuing evaluation is a formative and criterion-referenced assessment and it can include auto-evaluation.

The final evaluation is used to take information on the realized learning path. This is an assessment which gives the learner's performance reached at a given level of competence. This is a summative and often a certificative evaluation.

To evaluate the competences it is important to choose an appropriate instrument of evaluation in function of the aimed objective. For that reason, the reference taken is Tagliante who offers a grading table of written tests in relation with the cognitive categories of Bloom and de Landsheere [6].

After this theory on the evaluation of competences, our thought is getting precise on the topic which interests us: the tasks of written comprehension.

B. To Evaluate a Task for Written Comprehension

There are six levels for the competence of written comprehension. For each level, the evaluation criterions include the finality of the reading and the methods used to succeed in. The objectives of the evaluation of written comprehension are different in function of the evaluation times.

In the initial evaluation, the aim is to identify the learner's

aptitude for the realization of the written comprehension task that is what the strategies to get over the linguistic are, the cultural and the contextual difficulties and what the learner's ability of reading is [7].

In the continuing evaluation, the reader may orient his/her reading in function of the precised goal of the reading. The learner will adapt his/her method from this goal [7].

In the final evaluation, all these aptitudes and competences are tested [7].

For the instruments of evaluation used in the written comprehension tasks, our reference is Veltcheff and Hilton's typology [8]. It puts in relation a type of exercise with a type of answer in order to use a type of suitable exercise for a type of language proficiency.

After having studied the aspect of the evaluation of the written comprehension competence in a learning meaning, the following of our research is to study the cognitive activity of written comprehension texts and how it is possible to evaluate its cognitive processes.

C. To Evaluate the Cognitive Processes in Written Comprehension

Before the study of the evaluation of cognitive processes, it is important to come back on the three historical studies of the cognitive activity in written comprehension texts.

The first historical generation relies on the "product" of the written comprehension. This "product" requires the reader to have a "memory of the text comprehension". There are three levels of texts representation to put in memory [9]. These three levels are the *surface level* (the word and the syntax used in the text), the *semantic level* and the *situation model* (the model of representation built by the reader). More recently, the expression *situation model* applies to the meaning representation of the text when the reader has much previous knowledge and the expression *text base* when the reader has little previous knowledge. But this representation may be coherent. The coherence of the representation includes that the reader identifies the relations between the elements which constitute the mental representation. Hence the mental representation is a network of interconnected events, states and facts [10].

The second historical generation studies the cognitive processes which take place in the reading progress. This generation relies on the idea that there are limits of resources in attention. So the reader does a selective reading: he/she selects a few appropriate elements to understand the text. To select these elements, the reader activates linguistic elements, associated elements to the reading, and the inferences between the elements of the text that the reader produced from his/her previous knowledge. The researches have more recently taken into account the interaction between the resources of attention and the inferences production which aim is to preserve the coherence of the representation.

The third historical generation studies the cognitive processes and the "product" of the comprehension in the same time. During the reading, the activation of the elements (issued

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or inferred from the text) which constitute the representation moves in a continuous and dynamic way. It is hence possible to extract the product of the comprehension and to evaluate the inferential processes during the activity of comprehension. From the model of van den Broek *and al.* [11], [12], there are four sources of activation: the "contents of the sentence in the process of treatment", the "contents of the previous sentence", the "inferences charged to insure the coherence" and "the episodic representation in the process of building in memory". The third generation thus shows a complete representation of the text and the inference done.

Then, the temporary cognitive representation is an interaction between the knowledge and the thinking of the reader, the associated facts and the context of the comprehension activity. Blanc and Brouillet [10] expound three cognitive processes necessary to the comprehension text: the integration of information to understand the meaning of the message, the flexibility of the comprehension in relation with the context of reading and the selection of the appropriate information.

The first cognitive process is named the "integration process". To evaluate the *integration process*, it is necessary to take the reader's ability to stock built networks of meanings in memory into account with the help of the previous knowledge. These networks of meanings can be semantic analysis [13], [14] and space, temporal and contextual links [15]. The process of "semantic integration" was also experimented by Brouillet [16] for young children from the reading of sentences and afterwards their identification. Another more recent experiment shows that the reader puts the linked temporal and space elements more easily in memory than the formulation of the sentence to read [17].

According to the author, the second cognitive process is named "semantic flexibility", "structural variability" or else "conceptual flexibility". These notions mean that the meaning of the information depends on the context of the reading. This context is linked to the information of the reading situation, the aims of the reading and the information known by the reader. Blanc and Brouillet [10] present an adaptation of an experiment of Bransford and Mc Carrel in which the subject reads three texts in which only one sentence was changed every time. After each reading, the subject may say what he/she understood. With this experiment, it is possible to evaluate if the reader takes well into account the modifications and uses the process of flexibility in his/her representation of the text situation.

The third cognitive process is named the process of selection. To build a complete and coherent representation of the reading of a text, the reader hypothesizes, some hypotheses are kept by the reader and others are given out if his/her reading refutes his/her thinking. The ability to select the appropriate information and to refute others is the inhibition ability. To evaluate this process, in 2003, Blanc and Brouillet show how the subject proceeds when there is a contradiction in a text between two pieces of information. The researchers inject two contradictions in each text. After the reading of each text the subject realizes a task of inferences verification. One of the results of this experiment showed that "at a given time an inhibited information can be recuperated after even if it remains marked by the inhibition of which it was subjected to" [10].

After this theoretical presentation of meaning to evaluate the cognitive process in comprehension of texts, our model of cognitive processes evaluation is exposed in the following part.

IV. TOWARDS A MODEL TO EVALUATE THE CONGITIVE PROCESSES IN WRITTEN COMPREHENSION

A. Definition of the Text Comprehension

The definition of the text comprehension of Blanc and Brouillet [13] is used again: "the comprehension of a text can be defined as a dynamic process of building in memory of a coherent representation within the evoked situation and on which the generated inferences are added in the limit of the person's resources of attention".

Hence to understand a text, the reader may integrate the information and his/her knowledge in a coherent manner, use flexibility to adapt to the situational context of the reading and select the appropriate information to succeed in the process of comprehension [10].

B. The Method to Define the Cognitive Processes

First a theoretical model of typology of cognitive abilities is elaborated in written comprehension to the levels A2 of the CEFR. Secondly, this theoretical model will be experimented to make it pragmatic. A method is created to conceive this theoretical model of typology. For this, the language abilities [18] of each item of written communication tasks are picked out and will be experimented on the SdEFol[1] platform at the University University Rome Tre. For each language abilities picked out, the tasks are listed in a logical order of realization [18]. Each task is then related to a cognitive category of operations of the Taxonomy of Educational Objectives [19] and of the New Taxonomy of Educational Objectives [20]. These cognitive categories of operations are progressively declined in three under-categories. From these three defined under-categories, an action verb is identified in the graphic help-memory of Bloom Taxonomy [21] defined thanks to Bloom's Taxonomy and Marzano and Kendall's New Taxonomy.

An item of a written comprehension task is used again in our socio-cognitive scenario. From the three advertisements of cultural events, the learner must answer five questions. One of these questions means "Where does it take place? (city + country)" in English.

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[1] The SdEFol platform is a platform of Distance Formation developed at the University of Rome Tre under the direction of the Professor Gaetano Domenici, Director of the Department of Studies of Formative, Cultural and Intercultural Processes in the Contemporary Society.

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1- Jean Monet et sa peinture	2- Musiques populaires des îles	3- Images numériques et vidéos
Exposition de peintures Jean Monet Du 10/7/2009 au 5/9/2009 à Rouen (en France). Horaires : Lundi, jeudi de 8h à 12h et de 13h30 à 17h30 ; vendredi de 8h à 12h et de 13h30 à 16h30 ; samedi de 8h30 à12h. Tarifs : de 16 à 22 euros.	Spectacle de musiques populaires des îles Seychelles à Victoria (aux Seychelles) Le 20/7/2009 à 21h. Entrée gratuite.	Exposition d'images numériques et projections de vidéos à Toronto (au Québec) Du 26/6/2009 au 14/11/2009. Horaires : de 9h30 à 18h00. Tarifs : entrée normale du musée, 5 euros et 3,50 euros (tarif réduit)

Fig. 1 Document support for a task of written comprehension

To describe and define the cognitive processes of written comprehension of this item, two stages (Fig. 2 and TABLE. I) were necessary. In the first stage, one of the language ability used for this question was "To gather secondary information taken from a textual document and to use them again in" the production of the learner. This language ability was described in seven ordered language tasks (Fig. 2).

To gather secondary information taken from a textual document and to use them again in his/her production:

1. To identify (1) a main information in a written instruction
2. To identify (2) the part of the textual document studied before
3. To identify (3) a secondary information in a part of the document to study
4. To associate the main information of the written instruction to the part in which the requested information can be found
5. To extract the elements in each textual document from a written stimulus
6. To gather the elements (city name) to their space localisation (country name)
7. To reproduce the elements to give some information from a written stimulus.

Fig. 2 Method to describe cognitive processes

In the second stage, each learning task was defined according to the cognitive operations of Bloom and Marzano and Kendall. The comparison between the two definitions enabled to find an action cognitive verb according to Guité. For example, the two definitions of the learning task "to identify (3)": "to identify and to distinguish elements" according to Bloom Taxonomy and "To identify "how specific details are similar or different"" according to Marzano and Kendal New Taxonomy enabled to define the action cognitive verb "to detect" according to Guité (TABLE I).

TABLE I
METHOD TO DEFINE COGNITIVE PROCESSES

Language abilities (Lussier, 1992)	Role	Tasks asked to the learner (Lussier, 1992)	Cognitive operations according to Bloom's Taxonomy of Education Objectives (1969)	Cognitive operations according to Marzano and Kendall's New Taxonomy of Education Objectives (2007)
To gather	R	To associate	Analysis	Analysis
			- Research of relations	- Matching
			- "to determine certain of the main relations between elements"	- Matching Information
			- To join ("to analyse the relationships between the elements in an argumentation")	- To identify " how specific details are similar or different"
To re-use	P	To reproduce	Application	Knowledge Utilization
			- Application of specific principles	- Problem Solving
			- Use of specialized knowledge acquired during the learning	- Problem Solving With Information
			- To use an utterance by imitation from a written stimulus	To use "his or her knowledge of details to solve a specific problem or solve a problem regarding the details"
	R	To identify (1)	Knowledge	Retrieval
			- Knowledge of particular data	- Recalling
			- Knowledge of the terminology	- Recalling Information
			- To define ("to find the meaning of a word")	- To "recall about a specific vocabulary term"
	R	To identify (2)	Knowledge	Comprehension
			- Knowledge of means which enables the use of the particular data	- Integrating
			- Knowledge of classifications	- Integrating Information
			- To memorize ("To delimit the field covered by" former parts of the textual document)	- To identify "the essential versus non-essential elements of specific details"
	R	To identify (3)	Analysis	Analysis
			- Research of the elements	- Matching
			- To recognize and classify the elements	- Matching Information
			- To detect (To identify and to distinguish elements)	- To identify "how specific details are similar or different"
	R	To associate (1)	Knowledge	Retrieval
			- Knowledge of means which enables the use of the particular data	- Recognizing
			- Knowledge of classifications	- Recognizing Information
			- To join (to classify, to categorize "to improve the structure and schematize the phenomena")	- To recognize organizing ideas in "identifying accurate statements about generalizations and principles"
	P	To extract	Analysis	Analysis
			- Research of the elements	- Matching
			- To recognize and classify the elements	- Matching Information
			- To detect (To identify and to distinguish elements)	- To identify "how specific details are similar or different"
	R	To associate (2)	Knowledge	Retrieval
			- Knowledge of means which enables the use of the particular data	- Recognizing
			- Knowledge of classifications	- Recognizing Information
			- To join (to classify, to categorize "to improve the structure and schematize the phenomena")	- To recognize organizing ideas in "identifying accurate statements about generalizations and principles"
	P	To reproduce	Application	Knowledge Utilization
			- Application of specific principles	- Problem Solving
			- Use of specialized knowledge acquired during the learning	- Problem Solving With Information
			- To use an utterance by imitation from a written stimulus	To use "his or her knowledge of details to solve a specific problem or solve a problem regarding the details"

The two aimed competences of written communication studied here are the reception (R) and the production (P).

C. Towards a Model to Evaluate the Cognitive Processes by the Tutor On-Line

After the scientific research to describe and define the cognitive processes included in an item of written comprehension, our aim was to help the on-line tutor to evaluate them. The learner will be submitted to a qualitative questionnaire for that reason. The questionnaire is made from the method to define the cognitive processes (TABLE 1), but the language is adapted to the learner's comprehension. Moreover, the questionnaire is translated into the learner's mother language.

To precise the cognitive processes generated by the learner, the learner is asked if he/she used processes and then to put them in order. If he/she could use other cognitive processes is

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also checked and is asked him/her to write them in order.

d79. I put in order the name of a city and the name of a country taken from a text part. I write again the name of a city and the name of a country in a table of requests. For that:

		a	b	c	d	e	f
		0	1	2	3	4	5
1.	I remember the meaning of the important words of the instruction.	❑	❑	❑	❑	❑	❑
2.	I memorize the part of the text studied before.	❑	❑	❑	❑	❑	❑
3.	I detect the name of a city and the name of a country in a part of the text to study.	❑	❑	❑	❑	❑	❑
4.	I join the meaning of important words of the instruction to the text part to study.	❑	❑	❑	❑	❑	❑
5.	I recognize the city name and the country name.	❑	❑	❑	❑	❑	❑
6.	I join each name of the city to its geographic situation.	❑	❑	❑	❑	❑	❑
7.	I copy the city name and the country name where that city can be found.	❑	❑	❑	❑	❑	❑

Fig. 3 Questionnaire for the learner to help the on-line tutor to evaluate the cognitive processes

To help the on-line tutor to evaluate the learner's cognitive processes in written comprehension, both learner and on-line tutor were incited to interact on them with an asynchronous instrument in the experimentation.

V. CONCLUSION

To conclude, the first stage of our research was to show the evaluation of the cognitive processes on written comprehension tasks. From this scientific work, the experiment is expected in some time. Although this work has an evaluation made by the on-line tutor for objective, the interactivity between the learner, the computer and the on-line tutor will help the learner gain a co-reflexivity. In the end, this research aims at cognitive remediation.

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