A Web-based Training System for Business Letter Writing

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Abstract

As with the growing degree of office automation and diffuse use of electronic media, such as e-mails, written business communication is becoming a key element to promote synergies, relationships and disseminating information about products and services. Task recognition and the definition of strategies and suitable vocabularies are some of the activities that office workers deal with each time a communicative intent has to be effectively transferred and understood by a given addressee. This paper introduces a Web-based intelligent training system based on the Constructivism theory and Self-directed learning paradigms for assisting company workers in the drafting business letters-writing task. A case-based engine suggests ad hoc rhetorical letters that users have the chance to adapt to their particular contexts and save them into user-defined case libraries.

Key words: Business Letters, Intelligent Training Systems, Case Based Reasoning

1. Introduction

In the business world, Knowledge is a fundamental key of success. As with individuals, Knowledge is what enables the business to grow and succeed in a global market.

Automating Knowledge Management (KM) and exploitation undoubtedly leads to improved quality, reliability, speed, and overall business performance [10]. KM systems may employ various computational techniques for analyzing, representing and storing textual information, including: natural language analysis, data mining and information filtering and retrieval [8]. Nevertheless, Knowledge embedded in and carried through multiple entities including routines and policies is usually more difficult to recognize and capitalize for different tasks or activities. For these reasons, the latter kind of Knowledge is more likely to produce long-term sustainable advantages in competitive business markets [5].

One possible definition of Knowledge focuses on the process of applying expertise, or in other words, the awareness that enables people to possess the ability and the skill required to accomplish particular tasks [2]. In this process, Knowledge acquisition in terms of cognitive processes, such as perception, learning, communication, association and reasoning, is essential to build concrete know-how, crafts, and skills to apply to specific contexts, allowing them to make each time the most appropriate decisions.

Computer-based Learning provides technologies and associated methodologies in order to develop educational environments, where users are able to interact with special training programs that help understand functionalities of an application as they use it.

In broad terms, e-Learning guides learners through information, transferring Knowledge in terms of skills and expertise, helping them perform specific tasks. The principal advantages are to be seen in the opportunity to overcome several restrictions such as a scarcity of human teaching resources or the time spent for organizing complex and tailored courses for single learners and evaluating the acquired Knowledge levels.

In spite of that, advanced learning technologies are rarely integrated in KM systems. Existing Knowledge is identified, distributed and utilized by users to make better decisions but there is a lack of teaching practices that support tools and paradigms for effectively transferring and acquiring that Knowledge.

Nevertheless, current e-Learning technologies are mostly based on traditional teaching practices and focused on content creation and distribution, sometimes enhanced with collaborative features. They basically fail to model the current user activities and recognize Knowledge gaps that motivate the acquisition of new information and skills [11].

In this paper we introduce a case-based training system for letter writing in the business domain, based on Constructivism theories. Current state-of-the-art in this domain shows a lack of methodologies and tools for assisting users in this particular task, which involves human resources in almost any company and organization. Our Web-based tutoring assistant helps users acquiring skills and strategies for writing English rhetorically effective business letters. An innovative Knowledge-based task model together with a self-direct learning approach [16] guide users, in a non-directive way, in choosing resource materials, that can be pieced together to fit the information needs related to the current activities. Evaluation in real scenarios suggests that the learning strategies employed in the system result in positive worker outcomes.

The paper is organized as follows. First, we identify the underlying theories and paradigms that have inspired the development of the proposed system (Section 2). Before dealing with the structure of the internal Knowledge base in Sect. 2.2, we summarize the work of linguistic experts to identify important characteristics and elements of the business letter domain in Sect. 2.1. The case-based reasoner that proposes moves and letters related to the current user activities is introduced in Sect. 2.3, along a simple scenario of interaction with the Web-based system. The final sections provides an evaluation of the effectiveness of the proposed letter writing system in a real scenario (Section 3), and related works (Section 4). Conclusions and future work close the paper.

2. The Business Letter Writing System

The proposed system is based on *Constructivism* [19]. Traditional e-Learning environments are often driven by prescriptive interactions that allow learners to input information, but the responses to that input are often prescribed and deterministic. In contrast to this paradigm, open learning systems allow students participating more directly in shaping learning goals and choosing activities [13].

Our business letter writing system uses a holistic, self-directed, constructivist learning paradigm to motivate users to piece together the most effective business letter and to verify the effectiveness of the final product in real scenarios. The system does not directly judge the quality of the outcomes but leave the users to evaluate the effectiveness of the letter they produce. This assumes that users operates with an educational environment which allows them to assess real-world interactions, such as the opinions of their bosses and colleagues or feedbacks from sale representatives in contact with the recipients.

2.1. *The Business Letter model*

This section is focused on the research carried out by domain and linguistic experts to label the sample business letters that form part of the internal knowledge base of the system. The concepts of *move* and *strategy* will be proposed to define the rhetorical development underlying such intent and a metacognitive analysis of the tags will be proposed in dialoguing with the user. A letter is represented by a set of *moves*, where a *move* is a meaningful unit represented in linguistic lexical-grammatical forms and related to the communicative purposes of the activity in which members of the community are engaged [15]. In a business letter a single move is one of its several atomic rhetorical components; indeed, a business letter can be deemed as a sequence of rhetorical moves, each one expressing a particular communicative intent involving social and cognitive approaches to language comprehension and production.

Examples of moves are: Ask for Explanation, Encourage further Contacts, Solicit Communication.

Other important features characterizing a business letter are: *style*, *strategy*, *type* and some behavioral parameters that help represent the social context, such as the addressee's and sender's attitudes. These features are briefly discussed in the following paragraphs.

Letter Strategy. A writer's rhetorical strategy is defined as a particular path through written text, made up of a series of choices [15], in order to reach a particular communicative goal. Instances of available strategies are: Introduce product and create interest in visiting company's web site or Present arguments passing final judgment.

Letter Style. Every communication has its precise formulation, often proceeding from the interaction between the behavioral characteristics of the sender and the addressee, from the relationship that the two parties share and from temporary elements connected to the communication they put into effect. Examples of styles are: Contained Annoyance, Friendly, Courteous but firm.

Letter Type. A type represents a category of letters that share a general communicative intent, i.e., the key subject of one letter. Instances of letter types are: Offer of a new product, Apology for poor service or Apology for poor service.

Letter Addressee and Sender. The system represents a combination of characteristics that form the distinctive character of both sender and addressee. In the constructivist learning approach it becomes strategic to represent the social context too. These profiles can be edited by the user when writing a new letter to better represent the given context. A predefined set of letters, styles and types are included in the knowledge base as the result of the linguistic expert analysis of the business letter domain.

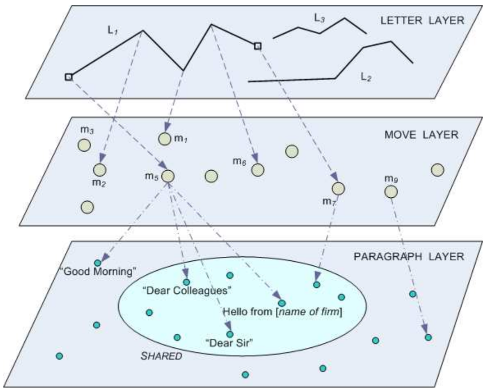

Fig. 1. An overview of the structure of the Knowledge Base of letters.

2.2. *The Knowledge Base of Letters*

After having introduced a model of the business letter domain, it is possible to define the Knowledge Base (KB) used to organize, store, retrieve and reuse information. An overview of the KB structure is depicted in Fig. 1, where it is possible to distinguish three different layers: *L-Layer*, *M-Layer* and *P-Layer*. This subdivision is motivated by the letter formalization given in Sect. 2.1 and in particular by the concept of communicative purpose named *move*. The different layers of abstraction represented by the KB allow to characterize conceptual attributes that are exploited by the case-based engine to structure and suggest new letters. Each of the layers is defined as follows.

The *P-Layer* contains objects representing distinct sections of a piece of writing. Each object basically realizes a *move* included in the *M-Layer*. In other words, this layer translates conceptual moves, that is, atomic communicative intents, into real textual representations that become part of a letter. The *P-Layer* is a set of elements: $L_p \equiv \{p_1, p_2 \ldots, p_n\}$ where p_i is one of the n paragraphs stored by the domain expert or by the user into the system knowledge base, each of which connected to a single move of the *M-Layer*. The *P-Layer* is the only layer that contains textual information for composing a letter. Formally, the layer includes a subset of shared paragraphs defined by a domain expert. The user has the chance to personalize the available paragraphs adding new elements.

As already stated in the previous section, the abstract key element of a communicative intent is the move m. We define *M-Layer* as the set L_m of all the atomic communicative intents: $L_m \equiv \{m_1, m_1 \ldots, m_n\}$, being m_i the generic abstract communicative intent, i.e., a move. Each move m stored by the domain experts or by users has associated one of more realizations in the *P-Layer*.

The *L-Layer* is the most abstract layer of the KB. It represents a user communicative need. This layer contains all the letters represented as abstract entities, composed of a sequence of communicative intents, i.e., moves. Therefore, a letter can be thought as a particular abstract pattern of atomic moves. We define the *L-Layer* the set L_l of all available letters: $L_l \equiv \{\boldsymbol{l_1}, \boldsymbol{l_2} \ldots, \boldsymbol{l_n}\}$, being $\boldsymbol{l_i}$ the generic abstract letter, instanced by the domain expert or by the user into the system's knowledge base. In particular, such a representation instantiates a letter into a particular path, that is, a direct graph in the *M-Layer*.

2.3. *The Case-Based Subsystem*

The Case-Based Subsystem is the AI component of the system that operates on the KB, analyzing the current context in order to retrieve and suggest new letters to the user. It is composed of two main components: the Case Library (CL) and the Case-Based Reasoner (CBR). The former is a KB repository of previously instantiated letters, while the CBR is the engine that performs the case-based reasoning process [1]. In particular, the main purpose of the CBR is to manage the CL, storing and retrieving, on-demand, new letter instances. Before discussing in depth the CBR, we give a formalization of some of the variables and parameters used by the reasoner for the CL analysis. The definitions are based on the concepts discussed in Sect. 2.1.

Definition 2.1 (Letter Strategies) *Letter Strategies is a set of elements:* $L_{str} \equiv \{str_1, str_1 \ldots, str_n\}$ *where* str_i *can be one of all rhetorical strategies stored by the domain expert or by the user in the system's knowledge base.*

Definition 2.2 (Letter Styles) *Letter Styles is a set of elements:* $L_{sty} \equiv \{sty_1, sty_2 \ldots, sty_n\}$ *where* sty_i *is one of all rhetorical styles stored by the domain expert or by the user into the system's knowledge base.*

Definition 2.3 (Letter Types) *Letter Types is a set of* n *elements:* $L_{typ} \equiv \{typ_1, typ_2 \ldots, typ_n\}$ *where* typ_i *is one of the types identified by the domain expert or by the user in the system's knowledge base.*

Definition 2.4 (Letter Senders) *Letter Senders is a set of elements:* $L_{sen} \equiv \{\boldsymbol{sen_1}, \boldsymbol{sen_2} \ldots, \boldsymbol{sen_n}\}$ *where* $\boldsymbol{sen_i}$ *is an array of seven boolean variables corresponding to the following personality features: Amiable, Analytic, Cooperative, Competitive, Cultured, Extrovert, Pragmatic.*

Definition 2.5 (Letter Addressees) *Letter Addressees is a set of elements:* $L_{adr} \equiv \{\boldsymbol{adr_1}, \boldsymbol{adr_2} \ldots, \boldsymbol{adr_n}\}$ *where* $\boldsymbol{adr_i}$ *is an array of seven boolean variables corresponding to the following personality features: Amiable, Analytic, Cooperative, Competitive, Cultured, Extrovert, Pragmatic.*

Definition 2.6 (Rhetorical Purpose) *We define a Rhetorical Purpose* RP *as a tuple composed by the following five elements:* $RP \equiv < L_{sty}, L_{str}, L_{typ}, L_{sen}, L_{adr} >$.

The tuple RP represents the communicative purpose of a letter, contextualized for a particular social context.

2.3.1. *The Case Library Representation*

The *CL* is a repository of *cases*, each of them defined by couples: of the type: $< OldProblem, OldSolution >$, being $OldProblem$ a formal representation of an old rhetorical purpose, i.e., acquired experience, stored in the *CL* by the user or by the domain expert, and $OldSolution$ the adopted solution to solve the corresponding communicative need, i.e., a path of movies.The *CL* represents an instance

Table 1
Two instances stored into the case library.

Rhetorical Purpose RP	**Letter** l
$< str_1, sty_1, typ_1, \boldsymbol{sen_1}, \boldsymbol{add_1} >$	OPENING APOLOGIZE END POLITELY CLOSURE
...	...
$< str_i, sty_i, typ_i, \boldsymbol{sen_i}, \boldsymbol{add_i} >$	OPENING THANK FOR INTEREST REFER TO PREVIOUS DECISION RESTATE DECISION DETAIL PRODUCTS JUSTIFY ACCEPTANCE SOLICIT COMMUNICATION CLOSURE
...	...

of $OldProblem$ as an RP tuple, while an $OldSolution$ is represented as a letter $\boldsymbol{l_j} \in L_l$ (see Tab. 1). In this way, a generic case C_k of the library is represented by the couple: $C_k \equiv < RP_i, \boldsymbol{l_j} >$.

2.3.2. *The Case-Based Reasoner*

A further relevant component of the system is the Case-Based Reasoner based on the well-known Case-based reasoning conceptual cycle [1] (see Fig. 2). During the writing process the user can rely on a sort of assistant whose goal is to give him, on-demand, suggestions about a new letter composition, based on the acquired experience. Consequently, the user has the chance to directly use the suggested letters or exploit part of them as a customizable template for creating a new instance. The four traditional stages of case-based reasoning applied in our domain will be discussed in the following sections.

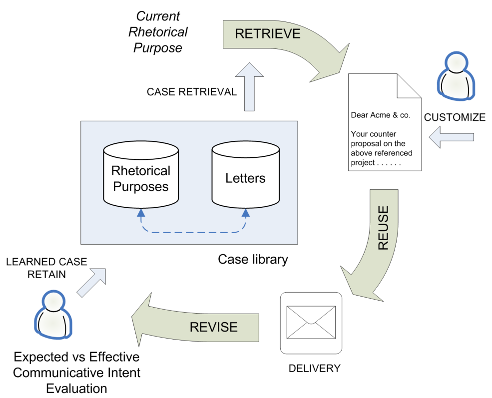

Fig. 2. The case-based reasoning cycle applied to the business letter writing domain.

Retrieve. In this phase the CBR, after having received in input an instance $NewProblem$ represented by a tuple RP, analyzes the CL and generates a ranked list of the most similar rhetorical purposes related to old cases. The case retrieval specifically works on two libraries: the user's personal CL, defined as CL_u, and the general starting CL, defined as CL_s, as provided by linguists. In this way, each user has a different personal library CL_u, related to the user-defined paragraphs (see Sect. **??**) and the case-based reasoning algorithm is always limited to the two aforementioned sets. In no event the search for a user's solution will assess cases that do not belong to him/her, other than those deemed common cases. The use of a single library, to be shared by all users, would surely lead to a quicker increase in the knowledge base. Yet, considering the diversities of the English language in the several contexts it is used in, the result would have been somewhat inaccurate and hardly customized: each user would receive suggestions proceeding indistinctively from the group of system's users. This would not allow the users to obtain suggestions based on their own preferences as regards the perception of the English language. On the other hand, having two different libraries allows everyone to personally interpret the concept of writing an effective business letter within the author's very context. Distance d between two tuples RP_i and RP_j is calculated as a linear combination of the individual distances between the several components that form it:

$$d(RP_i, RP_j) = \frac{1}{m}\sum_{k=0}^{5} w_k d_k \qquad (1)$$

being w coefficients real numbers that weight the different components (in the evaluation they take on the following empirically-derived values: $w_1 = 0.3$, $w_2 = 0.5$, $w_3 = 1$, $w_4 = 0.4$ and $w_5 = 0.4$). The d_i values are the following distances: $d_1 \equiv d_{sty}(sty_i, sty_j)$, $d_2 \equiv d_{str}(str_i, str_j)$, $d_3 \equiv d_{typ}(typ_i, typ_j)$, $d_4 \equiv d_{sen}(\boldsymbol{sen_i}, \boldsymbol{sen_j})$, $d_5 \equiv d_{adr}(\boldsymbol{adr_i}, \boldsymbol{adr_j})$. The distance d is normalized by a constant m that makes it fall into the [0,1] range. For example, in order to calculate the distance d_{sty} between two style attributes sty_i and sty_j, a boolean metrics was used, namely counting 1 when the two values match and 0 if they do not. The same metric has been employed for comparing strategies and types. In order to draw a distance between the two array components $\boldsymbol{sen_i}$ and $\boldsymbol{sen_k}$, the *Hamming Distance* was used, since the corresponding components are binary-type ones (see for example Ch. 2 in [12]). This metric has been used for assessing the comparison of addressees as well. Figure 3 shows an example of letter parameter selection. For style, strategy and type parameters, the users can choose preset values, set by the domain expert, or one among their own.

Reuse. The case-based reuse envisages the user's assessment of the results obtained in the previous phase, and possibly the selection of one of the suggested solutions, hence an adaptation of that choice to meet possible needs. Users are given a list of the likely solutions, shown in order of decreasing similarity. They may decide whether to entirely adopt one of the proposed solutions, selecting USE THIS SEQUENCE (see Fig. **??**), or just a part of the solution, either choosing individual moves or removing/replacing some moves from the selected solution. It is therefore a matter of adopting the solution provided to the contingent situation, and in this context, the user is granted total freedom of choice. The letter s/he is drafting is a sequence of pairs

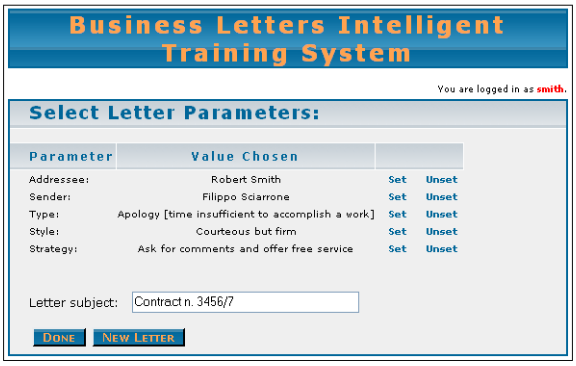

Fig. 3. The five elements that compose a rational purpose selected by the user.

of Move-Phrase, which may be modified under all aspects: in fact, the user may select moves from the alphabetic list, from the suggested sequences, s/he can replace moves, remove them, choose the phrase s/he deems best, possibly change it or add another, personal one, s/he can entirely adopt one of the suggested solutions and then amend it, and may also suggest new moves, should it be necessary. The system may be initialized with a limited set of letters identified by a domain expert, yet the commercial correspondence often requires writing many similar letters. By saving them in the CL, one will always be able to rely on a consistent set of suggestions. Along with the score obtained by the assessment of similarity between the input case and the case whose solution is presented, even the author's feedback to the letter is shown. This may help decide whether to choose a solution or not; possibly, a letter with an extremely negative feedback can be used as a clear example not to be followed. This phase ends with the completed letter; by this stage, the user has selected the moves and phrases s/he deemed best, resorting to the system's help at his/her will. By pressing the Save Work button in Fig. ??, the program redirects the user to a page where the final letter is presented. The user may temporarily save his/her work to resume it later on or save the letter in the KB. However, the letter will not be included in the case library until the following phase, i.e., the *Revise* phase, is over.

Revise. After having drafted the letter and saved it in the KB, the user should send it to the addressee and wait for the results. The revise phase is often the longest one of the whole case-based reasoning cycle, for it envisages the application of the solution retrieved from the engine and adapted by the user to his/her domain. The system constantly reminds the user how many of the letters s/he has written are awaiting feedback, signaling so in the main menu, in order to highlight it as soon as the user gains access to the system. The user is given four feedback values: Bad, Poor, Good and Excellent. Once the user has assessed the letter, it is saved in his/her CL and will help retrieve other solutions in future retrieve cycles. It is worthwhile noticing that in the event of similar cases being equal, the letters with a better feedback are shown first. Those that were given a low score are not excluded from the case retrieval procedure, since they can be used as an example not to be followed and to help the user recall his/her mistakes.

Retain. The retain phase is rather simple: once the data to be used within the case-based reasoning cycle are defined, they are already in the suitable form to be saved, that is in a problem-solution structure (see Sect.2.3.1). The problem is saved, together with all its parameters, while a solution is kept as a move sequence, with additional information to track down the case it belong to. In this way, it is easy to distinguish between the library where the search is conducted and the library that actually contains the solutions, on which the CBR does not work directly during the retrieve phase. This phase plays a key role even in the sorting of smart move suggestions (see the box Smart Moves in Fig. ??) helping the users, upon their request, choose the next conversational move to include in the letter s/he is drafting. Basically, the system - referring to the letters previously drafted by the user seeking advice - searches for the most commonly used conversational moves, starting from the very sequence of moves that has been partially input. A letter is seen as a path in an oriented graph, and the system, starting from a specific node, suggests the next, most frequently used node.

3. Evaluation

In our context, the Kirkpatrick four-level model [14] has been employed since it does not employ complex measures to assess, e.g., Return of Investment, while it focuses on learning variables. Essentially, our experiment investigates the effectiveness of two functionally different types of learning to write business letters: learning-by-BLITS and learning-by-hand. In learning-by-BLITS we further distinguish an intelligent modality and a normal one. The term BLITS denotes the proposed Web-based system. As for intelligent modality, we denote BLITS along with the CBR functionalities. The not intelligent modality refers to BLITS without the CBR engine, that is, without any suggestion of suitable letters by the system.

In this evaluation, we focus on the efficacy of the training process to provide learners with the ability to write effective letters, that is, as assessed by addressees. In other words, the learner's ability to communicate the message in a correct and effective way, which is the main goal of a business letter. This entails the following research questions:

- Q_1: Does the BLITS system without intelligent support effectively help learners to increase their ability to write effective English business letters compared to learners that learn to write English business letters without BLITS (e.g., by means of word processors)?
- Q_2: Do learners who use the intelligent component of BLITS write more effective letters with respect to learners who use the BLITS system without intelligent support?
- Q_3: Do learners who use the intelligent component of the

BLITS system write more effective letters with respect to learners that learn to write English business letters by hand?

The experimental conditions were created by manipulating one variable: the *instructional method*. Content of the writing sessions together with time spent on studying subject matter and on doing exercises were kept equal for all conditions. Learning-by-BLITS-intelligent-modality (LBI) was operationalized as individually writing different business letters. Also Learning-by-BLITS-normal-modality (LBN) was operationalized as individually writing different business letters. Finally, the third independent variable, that is Learning-by-hand-modality (LBH), was operationalized as individually writing different business letters by means of a text editor. There is one dependent variable, that is *learning*, considered as the improvement in writing business letters. We considered several indicators, measured in the post-tests, such as the letter style, organization and strategy.

3.1. *Experimental Setup*

Our experimental plan was designed to measure level 1 and level 2 of the Kirkpatrick model [14], by using the well known pre-test/post-test procedure. First, pre-tests, assessing the starting skill in business letters writing, together with background questionnaire were submitted. After we planned to perform three double-blind experiments in order to assess the validity of our system. In the first experiment we evaluated the added value given by the system used in its normal modality compared to the by-hand modality: LBN vs. LBH. In the second experiment we evaluated the ability of the intelligent component of the system to increase the student's learning in comparison to the use of the system without using the intelligent support: LBI Vs. LBN. In the third experiment we evaluated our system with respect to the by-hand learning: LBI Vs. LBH.

We submitted to our learners the following sets of questionnaires:

– *Background Questionnaire*. A questionnaire designed to group of learners in homogeneous starting levels.
– *Pre-test Questionnaires*. Some questionnaires were submitted to all learners in order to evaluate their starting level in Business letters writing. In particular, we proposed four questionnaires: Basic Business English, Basic Business Letters, Basic Business Letter writing and Business Letter Structure, in order to verify the learner's general background on the domain topics;
– *Post-test Questionnaires*. Some questionnaires, submitted to all learners, were designed to measure their skill after having produced their business letters, by the system or by hand. The questionnaires were, in their structure, similar to the pre-test four questionnaires;
– *Happy Sheet Questionnaire*. We submitted this kind of questionnaire to measure the level 1 of the Kirkpatrick model, i.e., the *Reaction Level*. This questionnaire was designed to have direct feedback from learners;

Pre-test and Post-test questionnaires were all designed to measure the level 2, i.e., the *Learning Level*, of the Kirkpatrick model.

For this first evaluation of the system, we selected a small, but statistically significant random sample of 24 learners, half of them from Computer Science courses and half from Administrative assistant and secretary schools, with the same level of familiarity in using Web-based applications, as assessed by the background questionnaire. Then, this sample was randomly divided into three groups of 8 learners, each one concerning the instructional modality used to produce the test-letters: the LBI group, the LBN group and the LBH group. For all learners the domain expert prepared three exercises to perform in two hours. Essentially, all learners were required to write three business letters. The maximum time to perform the exercises was set to two hours.

Table 2
Some Statistical Parameters.

	$\overline{x}_{pre-test}$	$\overline{x}_{post-test}$	$S_{pre-test}$	$S_{post-test}$	$\Delta_{Pre-Post}$
LBI	9.50	13.90	6.14	3.95	32%

3.2. *Data Gathering*

For each leaner, we gathered the following data:
– Four Pretest questionnaires.
– One Background questionnaire.
– Four Post-test questionnaire.
– One Happy Sheet questionnaire.

Table 2 shows the most important statistical variables summarizing the experimental data for the LBI modality. As we can see, between the pre-test and post-test there is a difference of $\Delta = 32\%$ in terms of average test score. In Figure **??** are summarized the answers to one of the 15 questions submitted to learners in the happy sheet questionnaire: *Does in your opinion this rhetorical approach to the drafting of business letters, based on sequences of moves help you to compose business letters?*. As we can see from the figure, almost all learners (91%) were satisfied with respect to the proposed rhetorical approach based on atomic rhetorical moves. This is an important pedagogical result because in the Self-directed paradigm, learners must be free to use the system as their own needs and this result states that the user found this approach stimulating.

3.3. *Hypothesis Testing*

We used the Wilcoxon-Mahn-Withney (WMW) non-parametric test [20], for two independent samples, in order to answer our research questions.

For all tests, the *Null Hypothesis* H_0 is: *There is no difference between the two samples score distributions*. The *Alternative Hypothesis* H_1 is: *There is a significative difference between the statistical distributions underlying the* *two sample scores*. The significance degree α was prefixed to $\alpha = 0.05$ a priori.

Table 3 shows the statistical results obtained by the selected test techniques. As can we see, the use of theBLITS system in its intelligent modality, i.e., LBI modality, gives added value to the learning process compared both to the LBH and LBN modalities (null hypothesis H_0 rejected). In both cases, our research hypotheses connected to the research questions Q_2 and Q_3 are strengthened: the CBR helps the learner. From both the WMW test we obtained: $p\!-\!value < \alpha$. Instead, the test of the LBN Vs. LBH has not showed the expected results. In fact, in this case, the null hypothesis H_0 is to be accepted because the test showed: $p - value > \alpha$. Essentially, this result indicates that there is no difference in the learning process between the LBN and LBH modalities: we can explain this, by observing that the user, when not supported by the intelligent component of the system, is not able to select the right letter from the CL. In fact, the CBR proposes the 5 most similar letters to the user allowing the inexpert user for a less cognitive overload in this selection of the draft letters among those proposed by the system. Instead, by the non-intelligent modality the learner is compelled to select the most similar letter by hand from the list of all the letters stored in the system database without any help.

Table 3
The WMW Test Results.

	LBI Vs. LBH	LBI Vs. LBN	LBN Vs. LBH
p-value	0,02	0,01	0,08
H_0	Rejected	Rejected	Accepted

4. Related Work

The proposed system supports Web-Based learning, which helps the user write rhetorically effective business letters in English. The main features of the system are basically twofold: the specific representation of a letter, based on a structured knowledge base, and the case-based approach of the support system. However, the current business solutions offers several products and tests that help the user write a business letter in the corporate context, albeit these products' approach is not based on linguistic rhetoric and on social/pedagogic paradigms, Constructivism and Self-directed learning, such as those our system is based on. They propose an environment for the management of structured letter templates, such as those used in the systems *Business-in-a-Box* [1] and *Business-Pro* [2] and in several business letter books [17, 6]. These tools don't help the user draft a letter step by step, they simply suggest a structured text, i.e., a template, with the relevant data to be input.

An example of an intelligent Web-based training system is TRIMAR [18], a system devised for Small and Medium Enterprises (SMEs), that uses a case-based approach to improve the employees' knowledge of the Internet as a marketing device. This system sets forth a KB based on old case studies, which the user selects and studies, along with an assessment tool, to evaluate the starting knowledge. Finally, the system features a CBR, based on 70 cases for retrieval, based on 9 index fields. Our system, unlike the TRIMAR system, is based on a more comprehensive approach in representing the context in which the employee works in. For example, the representation of the character of the sender and addressee whilst choosing the letter and the structure of the KB referring to our system domain reach a deeper and more structured learning level, because the user builds up his/her knowledge directly while contextualizing his/her problem, namely the communicative attempt of drafting a letter.

The WRITER'S AID [3] system is designed to support author writing efforts by performing various bibliographic tasks that typically arise in the process of writing a research manuscript. This system proposes a correct but incomplete KB, which is updated by means of a planner. In the proposed system the KB is directly updated by the work done by the user when drafting letters, and as they are saved in the case library, according to the educational paradigms employed.

Graham *et al.* [9] mention two methods to assist writers and remove stylistic inconsistency in a document. The first method suggests an approach based on two neural networks, whereas the second approach is based on bigram frequencies. Even in our system it is important to maintain a stylistic consistency in the produced letters. The method our system adopts is based on conversational moves, hence on paragraphs connected to them, which guide the user, from a stylistic point of view, in constructing the entire sentence, although the user may switch to the version proposed by the system if s/he wants to.

Blasius *et al.* [7] discusses a frame-based approach for business letters. The letters are modeled through a semantic network for a knowledge-based document analysis system. This representation of business letters does not take into account the rhetorical aspects, nor the communicative process behind the writing of a letter.

Finally, another useful piece of work for a comparison with our approach is the HATS method, set forth in [4]. This work suggests a method to write good routine business documents. The suggested process exclusively considers the methodological aspect of the considered domain. Basically, a best practice is given on how to write effective business letters, memos and emails and on how they should be clearly laid out, but it does not suggest modeling a letter according to the communicative intent and context. Therefore, what has been suggested could be the step following our system's output once the letter is drafted with the system, the layout rules the HATS method suggests could be emploied.

[1] http://www.envision-sbs.com/
[2] http://jcmsoftware.com/

5. Conclusions

The system is a case-based system designed to help workers draft effective business letters in English. The learning paradigm behind the system described here is inspired by two modern educational approaches: Constructivism and Self-directed learning. In spite of traditional approaches, the system leaves it up to users to evaluate and make judgments of what effective writing means in a given situation, according to a number of suggested alternatives and the outcomes obtained in previous correspondence. A case-based reasoner suggests ad hoc templates that the user has the chance to adapt to particular contexts and saves them into user-defined case libraries. The system does not work as simple grammar-checkers of a work processor but as an assistant that suggests highly appropriate alternatives in terms of paragraphes and letters related to the current needs.

The business letters are represented by sequences of abstract comunicative intents, named moves, and stored in a KB along with user/recipient models. A single case is constituted by correlations among these information. By means of this original structure of knowledge and a case-based reasoner, the system is able to select the most appropriate cases for the letter-writing assignment undertaken by the user, who wish to write an effective business letter in English.

We evaluated the system through a non-parametric statistic technique, based on the Wilcoxon-Mahn-Withney test. Three different experiments were performed, in order to accept or reject our three research hypotheses. As a result the evaluation confirmed two expectations: the system with its intelligent modality helps the learner to write business letters in a more effective way, w.r.t. traditional word processing or not intelligent modalities, as assessed by a domain expert. As future work we plan a broader experimentation of the system in real companies in order to verify the system efficacy and the third and fourth level of the Kirkpatrick model, that is, transfer and result performances in a real business company.

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