9th International Conference on Higher Education Advances (HEAd'23)
Universitat Politècnica de València, València, 2023
DOI: http://dx.doi.org/10.4995/HEAd23.2023.16149

Information skills instruction in higher education students using the 4C/ID model

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Abstract

Information skills instruction continues to be a pending subject among university students despite the fact that they handle the Internet with ease, since the ability to define what is needed, to be strategic when deciding where to search and how, to select the information most appropriate and relevant and to use it properly is not routinely taught. The purpose of this article is to show how the 4C/ID model is applied to the design of this skill, the challenges encountered in its adaptation and the improvement in self-perceived efficacy by students. The results show that the model is successful and the students felt more prepared to face this type of tasks in the future.

Keywords: *4C/ID model; information skills instruction; online; higher education.*

1. Introduction

University students regularly use the Internet to find information for their academic work. Traditional libraries have been largely replaced by massive scientific databases and academic search engines to provide the information that students require in their work at the University. However, many students lack the ability to find the information they need and use it competently in their academic texts (Zhou & Lam, 2019). Although many students claim to be digital natives, using the Internet for academic purposes is not the same as using it for leisure purposes (Hinchliffe et al., 2018). This deficiency in their informational skills implies a great effort for their teachers, who must invest a lot of time and resources in training the students (Lanning & Mallek, 2017). And although this training has traditionally fallen on librarians and information management specialists, the information skill required is increasingly specific (Taylor, 2012) and less generic, so many professionals from other academic fields (engineering, medicine, law) are nowadays responsible for working on this skill with their students.

This complex cognitive skill is often referred to as information literacy (IL) or information problem solving (IPS) and has been widely explained by different theoretical perspectives and approaches (ACRL, 2016; Brand-Gruwel et al., 2005; Brand-Gruwel et al., 2009; Catts & Lau, 2008). IL involves much more than just searching the Internet. It is a complex process that always points to a specific goal (Garcia & Badia, 2017). It begins with the ability to clearly identify what you want to search for (the definition phase), the selection of the best ways to search for information (which tools to use, which search engines, databases), the strategic application of searches (use of Booleans, keywords, key authors), the selection and organization of the information from the results (what to choose, for what purpose) obtained and the integration of that information in a coherent and orderly manner with the personal texts of the students. It is a more complex process than it seems at first sight and it cannot be resolved simply by browsing the Internet or using social networks (Argelagós & Pifarré, 2016). To carry out this process properly, instruction and a critical attitude are needed (Frerejean et al., 2019).

The 4C/ID model is an instructional approach whose primary objective is to help to teach complex skills or professional competencies (Van Merriënboer et al., 2002). It is a task-centred instructional model (Francom, 2016) that aims to avoid the fragmentation of knowledge in favour of a flexible and interconnected integration of knowledge, skills and attitudes (Van Merriënboer & Kirschner, 2018). It is based on four main components: (1) learning tasks, (2) supportive information, (3) procedural information, and (4) part-task practice.

1. Learning tasks are the backbone of the educational program, as, for instance, cases, projects, professional tasks, problems, or assignments that students work on.

Learning tasks encourage inductive learning: students learn by doing and confronting particular experiences. The learning tasks in the 4C/ID model must meet a series of characteristics: their variability, that is, they must be different so that they represent all the dimensions that are found in the professional environment, and also the level of complexity of the tasks must be different and progressive, like the support received from the instructor, which should be decreased gradually by the process known as 'scaffolding". Finally, upon completion of the last tasks, the student should be able to perform them correctly on his own.

2. The second component of the model is the supportive information (sometimes called "theoretical information"), which helps students to perform the non-routine aspects of learning tasks, which often require problem solving, reasoning, and/or decision making. Supporting information provides the link between what students already know (i.e. prior knowledge) and what they need to know in order to perform the learning tasks.
3. The procedural information helps students to execute routine aspects of the learning tasks, that is, those aspects that are always performed the same way. This information must be presented the first time the student performs that aspect as part of a learning task. For subsequent tasks, the presentation of the procedural information has to be gradually removed since its need decreases as the student gradually masters the routine.
4. Part-task practice aims at strengthening cognitive rules through extensive repetitive practice. It is important to begin the practice of a part of the task within a fruitful cognitive context, that is, after students have faced the routine aspect as part of a complete and meaningful learning task. Then, students will understand that practice can help them improve their performance in all tasks.

The objective of this article is to show the adaptation process of the 4C/ID model for information skills instruction of university students in a completely online environment. The reason for selecting the 4C/ID model to train this skill is precisely that it is a complex cognitive skill, which is usually taught following classical instructional methods or its design focuses only on part of the skill, on the search for information (Koufogiannakis & Wiebe, 2006). As well, we wanted to find out if students felt more prepared to this type of task after completing a 4C/ID course on information skills.

2. Methodology

2.1. Context of the study

The context of the study was the Faculty of Education of a Spanish university whose academic model is completely online. Both 4-year degrees and one-year university master's

degrees are studied at this Faculty. At the end of their academic programme, students have to present a final study manuscript (between 40 and 80 pages) that always incorporates a theoretical framework and that requires the application of information skills by the students. The students who were going to be part of the voluntary instructional process belonged to the degree in early childhood education and in primary education, the master's degree in special education, in neuropsychology and education, and in psych pedagogy.

2.2. Design process

Since students belonged to a virtual university, it was decided to generate an instruction that combined synchrony (adobe connect) and asynchrony (pdf, videos and mind maps) tools. So, for the instruction, we decided to land the 4 components of the 4C/ID model (see figue 1):

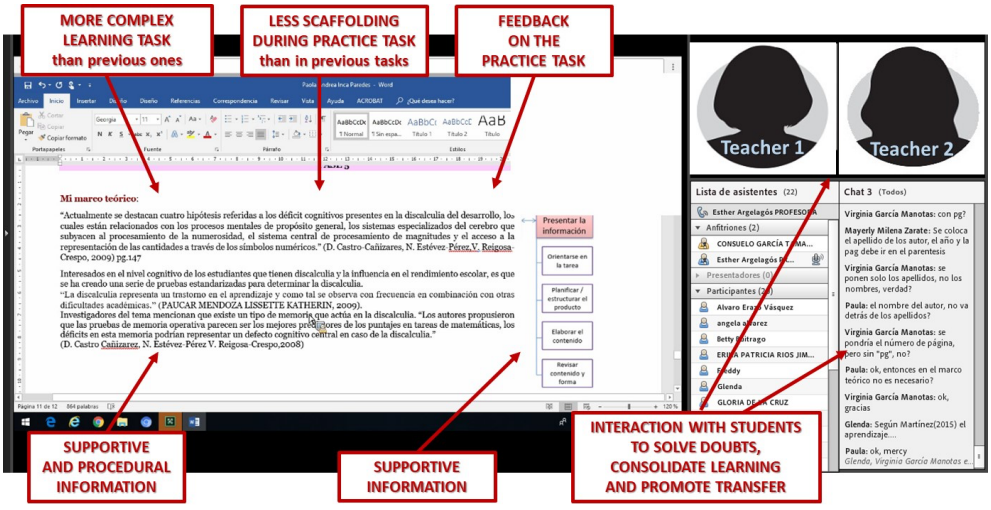

Figure 1. Example of synchronous session. Source: own

- Learning Tasks. They had to be relevant for the student's real life and also had to have different levels of complexity so that the students could feel comfortable and gain more confidence in themselves. We chose the following topics: (1) gamification and learning, (2) cyberbullying and childhood, (3) metacognitive strategies in primary education, (4) cooperative learning and (5) personal choice of each student.
- Supportive information. A pdf content was elaborated to explain the student the main components of the instructional model, which help them to understand and follow step by step the complete process to write the contents needed for a theoretical framework of an academic text, based on the results obtained.
- Procedural information. Modelling examples video recorded were key to show students how to proceed to apply the instruction by themselves. Having an expert

doing and reflecting on what to do, even incorporating mistakes and failures was fundamental to include the routine aspects of the information process.

- Part-task practice. This was approached in two ways: firstly, the teachers taught in synchronous classes how each part of the information process was applied, and secondly, the students practiced that part of the process autonomously but with the support of the written and audio-visual material. In such a way that at the beginning the students received a lot of guidance from their teachers, but in the end, the task had to be carried out completely autonomously.

2.3. Course instruction

In order to carry out the complete instructional process, it was decided to structure the course contents, the modelling examples and the synchronous classes according to the step-by-step model (see figure 2) designed by Brand-Gruwel et al., (2005).

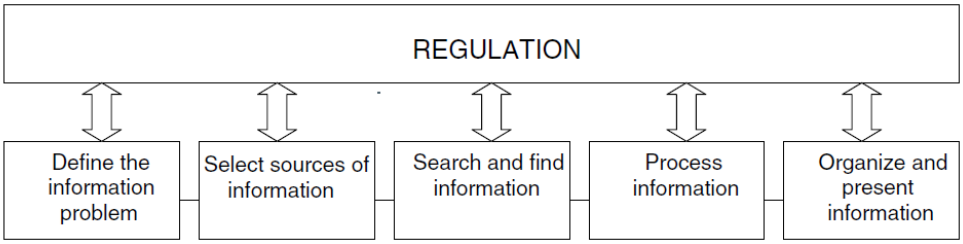

Figure 2. Descriptive model for information problem solving. Source: Brand-Gruwel et al., (2005).

First, the ability to define research questions was deployed by the teachers, explaining all the steps involved in the development of this ability: topic analysis, activation of prior knowledge, how to specify a topic and how to establish research questions. Secondly, the focus was on the selection of academic sources and search strategies, how to carry them out through google scholar and the databases of the university, how to use the thesaurus, keywords and Booleans within search engines or metasearch engines and how to carry out an initial evaluation of the results based on a checklist to control the reliability, veracity and timeliness of the source. In the third place, the analysis of the results, the selection and the summary of the publications found for its later consultation was worked. And, eventually, the teachers showed how to analyse and extract the relevant information from the relevant sources and how to integrate the information. Subsequently, the last section of contents was oriented to how to organize and present the information, plan the text and the fundamentals to paraphrase, quote and correctly incorporate the information found in the content itself.

At the beginning of the course, the students received the following action guideline (which was repeated in each phase of the instructional process):

1. Read the .pdf that explains the step to be carried out.

2. Watch the video (as many times as necessary) about the step to be taken.

3. Run the task (see the video while it is being done).

4. Reflect on the results.

5. Share doubts with the teacher in the Connect session

6. Attend the next class.

7. Perform the following task.

8. Start with step 1 again.

The resolution of the task allows to reflect on the results and problems encountered. During the connect session with the teacher, you will see the results that you should have obtained and the teachers will explain in detail the steps that should have followed, and they will resolve the doubts that you may have in relation to the phase worked on. To begin with, remember to watch the first video that explains all the steps to carry out the search and use of the information needed to write a theoretical framework.

In task 1 the complete instruction of the process was shown and shaped by the teachers. In tasks 2 and 3 the part-task practice was applied so that the students internalized the routines supported by the procedural information. In task 4 the students carried out the activity autonomously with prompts and occasional help from the teachers. Finally, the students performed the last task without help. The course lasted two months, the first four tasks were developed during 3 weeks, and the last task (autonomous) was done one month after the instruction.

2.4. Participants

The call for the voluntary course and subsequent research was made to 120 students, and 80 (28.8 % female, 36.86 average age) accepted to participate. Finally, 25 completed the entire course and 55 did not. The Self-Efficacy Scale for Information Searching Behaviour (SES-IB-16; Rosman et al., 2015) is a questionnaire to measure self-reported information literacy. It was used to measure students' assessment about their possibilities of successfully approaching the task of preparing the theoretical framework of their final project. It was filled out by the students before and after completing the course.

2.5. Data anaylsis

Improvement in students' self-perceived efficacy was analysed by means of a mixed analysis of variance (ANOVA) using group (experimental and control) as an intergroup factor, and the pre-test and post-test results of the SES-IB-16 as an intragroup factor, applying SPSS v18.

3. Results and conclusions

The application of 4C/ID model to information skills instruction was successful. On the one hand, the main challenges we had to address in the adaptation were of a different nature. The first was to start from a global vision of the entire training process from an expert perspective, in order to break it down into its parts. The conceptual framework of the IPS skills by Brand-Gruwel et al., (2005) was of great help, when comparing the skill breakdown of the model with the steps carried out by the expert. Secondly, we had to decide what each task would consist of, not only the different content but also their different level of complexity. And how to scaffold during the instruction period was another of the issues we faced, since the objective was for students to internalize the most routine mechanisms to address more complex aspects, as they progressed in their training. Another challenge was deciding the timing of the classes to give students time to complete the parts of the tasks, attend classes, share the results and reflect on their mistakes and successes. We made the decision to leave a long period of time (one month) between the instruction and the delivery of the last task (free theme developed autonomously) so that the students had time to reflect on everything they practiced and learned.

On the other hand, from the teachers' point of view, the process was enriching when observing how the students progressively not only understood what they had to do to solve the tasks, but also became more and more autonomous in the process of defining, searching, selecting and elaborating the information for the theoretical frameworks of their academic thesis. It was a little more difficult to personally manage each student during the synchronous classes, but the decision to expose the "best" results and share the most common mistakes was very helpful for the students.

Finally, on the part of the students, the feeling of self-efficacy of the group that took the course was significantly higher than the group that did not take it. In the case of the self-efficacy expectations measured by SES-IB-16, we observe that there is an intra-subject effect [$F_{1,78} = 25.27$, $p < .001$, $\eta^2_{partial} = .245$] and interaction between this factor and the group [$F_{1,78} = 16.08$, $p < .001$, $\eta^2_{partial} = .171$] with a high effect size, so the training was considered very effective. So, we consider the task centred approach of the 4C/ID model, based on an integration of knowledge, skills and attitudes (Van Merriënboer & Kirschner, 2018) helpful for information skills instruction and to increase students's sense of future success concerning their academic challenge at the end of their university studies.

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