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Numbers: from stumbling block to training tool

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Abstract

Numbers are the most common and complex problem trigger for interpreters. Previous research on the topic highlighted a correlation between errors and specific skill deficiencies, suggesting that this difficulty may be overcome through targeted training. However, no systematic training method has yet been developed to address this vexing problem. This article presents a constructivist, skill-based training programme designed on the basis of research findings with the aim to develop interpreting trainees' competence in the simultaneous interpretation (SI) of numbers. The article outlines the theoretical underpinning of the training programme and its design. It then presents the results of a small-case study conducted through design-focused evaluation to explore the impact of the chosen instructional design strategies on participants' learning process. Two groups of interpreting trainees (5 in each group) participated in the training programme and, in the end, provided the author with unstructured written feedback. The responses were analysed by qualitative thematic analysis. The analysis reveals participants' perception of how the instructional design principles underpinning the training programme supported their learning process, leading to hypotheses for future studies on instructional design for conference interpreter training. The analysis also reports participants' perceived training outcomes and highlights the transfer of skills and techniques to different interpreting tasks, modes and language combinations. Overall, the article aims to contribute to the field's understanding of the difficulty in interpreting numbers and addresses the need for a pedagogical response to this challenge. It also aims to highlight the potential of instructional design research to advance the current stand of interpreting pedagogy.

Keywords

Simultaneous Interpreting, numbers, number comprehension, interpreter training, cognitive skill acquisition, metacognition, instructional design, design-focused evaluation.

Introduction

> Conference interpreters are made, not born […] This highlights the importance of training, particularly formal/institutional training, for conference interpreters […] Formal training can help individuals who wish to become professional interpreters enhance their performance to the full extent of their potential as well as helping them develop their interpreting skills more rapidly than they could through field experience and self-instruction. (Fan 2012: 1)

When talking about the *Theoretical and Practical Aspects of Teaching Conference Interpretation*, one of the main questions that arises is the relationship between interpreting theory/research and interpreter training. The landmark Trieste conference of 1986 (Dodds/Gran 1989) contributed to a shift in interpreting research from 'personal theorising' (Setton 2010) to scientific knowledge backed by empirical data. In the same way, over the years, interpreter education has seen a shift from an anecdotal teaching approach mainly driven by the trainer's subjective experience to a "systematic, structured training methodology based on solid theoretical research findings" (Kalina 2000: 9).

Despite the substantial achievements made through the years, it is not possible to affirm that such shift has been completed. A first reason is that some misconceptions about interpreter training still risk preventing the successful reception of research findings in interpreter education. For instance, Pöchhacker (2010) points out that interpreter training in some educational institutions is still based on a "master-apprentice model". The underlying assumption is that learning occurs through the transmission of practical knowledge from the master of the craft – the practising trainer – to the want-to-be interpreter. The role of theory and research in such a model appears to be very limited. Only marginal importance is attributed to the trainer's theoretical knowledge of interpreting and pedagogy, such as fundamental principles and processes inherent in the interpreting task and factors stimulating or inhibiting learning. Furthermore, such a master-apprentice model does not assert the need to create a rigorous, theoretically sound teaching framework to enable students to achieve desired learning objectives. Considering the complex nature of interpreting skills and the requirements of the acquisition process, however, it appears reasonable that systematic training may be more effective than minimally guided approaches in supporting trainees' development of interpreting expertise. A second reason why the shift from an anecdotal approach to systematic interpreter training may still be regarded as incomplete lies in the lack of a comprehensive, research-based teaching methodology in some areas of interpreting pedagogy. One such exam-

ple is represented by the pedagogy of number interpreting. The difficulty commonly associated with interpreting these elements makes numbers eligible to receive priority in interpreter training. Despite this, a systematic framework for training and instruction on how to interpret numbers is still missing.

Numbers are generally acknowledged as a major stumbling block for interpreters, capable of disrupting interpretation and triggering gross sense contradictions (Frittella 2017). They were found to be even more problematic than other problem triggers, such as names (Lamberger-Felber 2001). Numbers are statistically correlated with a sensible reduction in the quality of the interpreter's delivery when this is assessed by parameters such as completeness, accuracy, plausibility, fluency, and effectiveness (Frittella 2017). The studies on interpreting trainees' SI of numbers reported an average error rate above 40% (Mazza 2001; Pinochi 2009). However, despite the "ready identification of numbers as a source of difficulty for the interpreter" (Mead 2015: 287), so far, research has failed to identify a concrete answer and even concluded that "there does not seem to be any real solution to this problem" (Pinochi 2009: 55). As a consequence, the inclusion of numbers in the interpreter training curriculum and the selection of training strategies still largely depends on the deliberate choices of the trainer rather than on research-based best practices (Frittella 2017). However, training shortages seem to be a major cause of students' inability to explain their difficulties in interpreting numbers and their lack of awareness of viable coping methods, which, in turn, seems to correlate with their errors (*ibid*.). For instance, the study just mentioned reports that the participants did not prepare on numbers although they had received key information one week before the experiment and they knew that they would interpret a number-dense speech. In the retrospective questionnaire, they did not show any awareness of the importance of acquiring relevant *encyclopaedic numerical knowledge* (Cappelletti *et al.* 2008) in preparation for interpreting numbers[1].

Numbers can be defined as highly cognitively demanding for several reasons. From a *cognitivist perspective*, the mental processes inherent in the transformation of a source-language (SL) number word into the corresponding target-language (TL) number word cause an increase in task requirements compared to the interpretation of other text elements[2]. From a *functionalist perspective*, numbers are elements that contribute to the information structure of the source text, that convey meaning and produce sense by interacting with the listener's background knowledge, and that have a specific communicative function in relation to the speaker's purpose: informing, persuading or evoking a desired effect on the audience. For this reason, numbers have a variable degree of semantic, cognitive and pragmatic redundancy (for the definition of the terms, see Černov 2004). From this point of view, the interpretation of numbers is not limited to a mere asemantic transcoding process ('literal translation', Braun/Clarici 1996), requiring

1 See Frittella (2017, 2019) on the implications of preparation on numbers and the acquisition of *encyclopaedic numerical knowledge* for the interpreter.

2 See Frittella (2017, 2019) for a comprehensive review of the causes of difficulty in number interpreting and a discussion of the implications of analysing number interpreting from a *cognitivist* and a *functionalist* perspective.

the interpreter to have mastered the ability to rapidly switch from 'intelligent' to 'literal hearing' (Pinochi 2009). It also involves processes such as anticipation, analysis and inferencing and, hence, implies multiple complex cognitive skills.

To the author's knowledge, the present article proposes the first systematic training programme for the SI of numbers, which aims to train the skills inherent in number interpreting. The starting point of the skill-based training programme was the author's previous research project (Frittella 2017, 2019), which served as a basis to develop a model of number interpreting and of the skills involved in this task. The course design process was also informed by a review of state-of-the-art scientific knowledge about complex cognitive skills, the requirements of the acquisition process, effective instructional design (ID) principles and influencing variables determined by the learner's cognitive and affective engagement in the learning process. The article also presents a small-case study conducted to evaluate the effectiveness of the ID principles underlying the training programme. This is an exploratory study involving two groups of participants: BA and MA interpreting trainees with Italian as their mother tongue and English as one of their working languages. Based on design-focused evaluation (DFE, Smith 2008), the author gathered participants' unstructured feedback at the end of the training programme and analysed the written responses by thematic analysis.

The article is structured as follows. First, it presents the theoretical pillars of the training programme, including a review of ID for cognitive skill training and the competence model of *number interpreting as skilled performance* developed by the author. Second, the article summarises the key characteristics of the course design and provides examples of the training activities. Third, it presents the study design. Fourth, it outlines the results of the thematic analysis of participants' feedback. Fifth, it discusses the author's interpretation of the results in light of relevant theory. Finally, it presents the conclusions of the present study and its future developments. In the context sketched above, this article pursues a double aim. On the one hand, it addresses the practical need of proposing a concrete answer to the vexing problem posed by interpreting numbers. On the other hand, it aims to draw the field's attention to the potential of instructional design research to advance the current stand of conference interpreting pedagogy.

1. Theoretical framework

1.1 Instructional design for skill acquisition

Simultaneous interpreting (SI) may be regarded as an example of expert performance, involving the concurrent use of multiple complex cognitive skills and requiring solving problems under time constraints and psychological pressure. The acquisition of interpreting expertise is influenced by several variables, such as the design of the training programme, the trainee's cognitive engagement, and affective aspects.

Instructional design is a discipline providing educators with a theoretical framework and research-based principles that allow them to target their courses to the intended objectives (Schott/Seel 2015). The design of a course comprises three fundamental components (Biggs/Tang 2007): the objectives, or *intended learning outcomes* (ILOs); the *teaching/learning activities*[3] (TLAs); and the *assessment tasks* (ATs). A model of the skill which is the object of training represents the starting point of instructional design for complex cognitive skills (for instance, as detailed in the *4C/ID model*, van Merriënboer 1997). The characteristics of the target skill and the requirements of the acquisition process from a psychological perspective determine the identification of both the objectives and the suitable TLAs.

Complex cognitive skills, such as the ones involved in interpreting, are defined as the result of sub-skills organised in a hierarchical structure (Speelman/Kirsner 2005). The learning and accurate performance of higher-order skills depend on the successful acquisition of fundamental sub-skills (Anderson 2004). Such skills can be divided into two categories according to their nature and their role in skilled performance (van Merriënboer 1997). *Recurrent skills* come into play in the execution of all repetitive aspects of a task (*ibid*.). Successful performance depends on their degree of *automaticity*, meaning that their execution is spontaneous, effortless, fast and errorless. An example of recurrent skill in the SI of numbers is the decoding (mental processing) of the source-language number word. *Non-recurrent skills* allow us to deal with variable aspects of tasks and new problem situations (*ibid*.). They imply the acquisition of *schemata*: highly generalised task knowledge built for those aspects of performance that are consistent across problem situations. An example of a non-recurrent skill in the SI of numbers is the summary explanation of a highly number-dense passage based on its semantic meaning – for instance, by providing the listeners with a description and explanatory inferences on the evolution of a trend over time, where the information density makes it very difficult to convey all numbers.

Different learning processes underly the acquisition of recurrent and non-recurrent skill components (*ibid*.). The acquisition of recurrent skills takes place by *rule automation*, which requires extensive task repetition to generate highly domain-specific procedures. Schemata are associated with expertise and their creation is deliberate, meaning that task repetition alone is not sufficient: the process requires the learner's conscious attention to abstract task-related patterns and identify effective behaviours. Successful learning processes build the learner's *reflective expertise* and increase the potential for *skill transfer* across tasks (van Merriënboer *et al.* 1992).

To support the desired learning processes, the TLAs must be targeted to achieve the intended objective. Each learning activity must present the learners with meaningful tasks that enable them to focus on the specific target skill (Ohlsson 1993: 171). It is indispensable to modulate task requirements to prevent the high cognitive load in the initial stage of skill acquisition from inhibiting the process and demotivating the learner (van Merriënboer/Sweller 2005). Task

3 The term 'training activities' is used in the present article to refer to interpreting exercises.

requirements can be modulated through sequencing strategies, which can be of two types (*ibid*.: 158): *part-task sequencing* involves practising individual task components in isolation before merging them into a complex whole. *Task-whole sequencing* involves practising the same task at increasing difficulty. Nevertheless, the design of the activities must take into account the nature of the skills trained, as the different learning processes involved in the acquisition of recurrent and non-recurrent skills require different ID strategies. The automaticity of recurrent skills is best supported through *restricted encoding*: practising the skill "out of context", in tasks that do not require further complex mental processes by the learner (van Merriënboer 1997). Schema construction for non-recurrent skills, on the contrary, requires practising the same skill in different contexts and reflecting on the shared features among tasks to abstract generalised patterns – a process of *mindful abstraction* (*ibid*).

Other than the design of the training programme, another factor influencing the acquisition of complex cognitive skills is learners' cognitive engagement in the learning task. The learner's *metacognitive skills* determine their patterns of self-assessment and self-regulation during learning. *Self-assessment* (Black/Wiliam 2009) implies comparing one's current performance against some standard. *Self-regulation* (Zimmerman 2002) means learning with a focus on attaining meaningful, self-set goals, monitoring one's progress during learning and adjusting one's learning strategies. Ensuring the effectiveness of these processes requires support by the trainer and dedicated ID strategies. Effective instruction provides learners with the necessary knowledge structures to comprehend the task and its inherent learning objectives, plan their learning, detect and correct the causes of error. Some key elements of effective instruction are, therefore, providing the learners with background domain knowledge and feedback (Ohlsson 1993). In the field of conference interpreter training, a number of studies identified trainees' metacognitive skills (Doğan *et al.* 2009), their engagement in goal-directed practice (Dingfelder Stone 2015), self-regulation and self-assessment (Fan 2012; Motta 2016) as crucial to the development of interpreting expertise. These studies also stressed the need for trainers to develop metacognitive skills in interpreting trainees through dedicated strategies and instruments, such as reflective protocols (Doğan *et al.* 2009), journals (Fan 2012) and digital tools (Motta 2016).

Finally, the outcome of training complex cognitive skills is influenced by affective aspects such as learners' motivation. John Biggs highlights that "motivation is a product of good teaching, not its prerequisite" (Biggs 1999: 61). He suggests using the principle of *constructive alignment* to ensure that a course is internally consistent and supports students' motivation. This ID principle implies a goal-centred design in which the objectives determine the selection of the TLAs and correspond to the assessment criteria. To motivate the student, the intended learning outcome of the course must be in line with the students' personal objectives and the TLAs must appear relevant to achieve such objectives. The concept of *self-efficacy beliefs* identifies the learners' confidence in their ability to achieve their self-set objectives through the efforts invested in training (Bandura 1986). This can be influenced through evaluation linking students' performance to *unstable* rather than to *stable* factors (Schunk/Zimmerman 2008) – i.e. to factors within

the learners' control, such as ineffective study practices or skill gaps rather than to the students' inborn ability. Studies in the field of conference interpreter training highlighted the crucial impact of trainees' motivation on learning performance and showed that the trainer's feedback, if it links performance to stable rather than unstable factors, can be demotivating for the interpreting trainee (Wu 2016). A demotivating effect was also linked to a lack of systematic trainer's guidance and to inconsistent guidance from different trainers (Takeda 2010: 42).

1.2 Competence model of number interpreting as skilled performance

The *competence model of number interpreting as skilled performance* presented hereafter is based on the author's previous adaptation of Gelij Černov's *probability prediction model* (2004) to number interpreting for analytic purposes (Frittella 2017), later called *redundancy ladder model* (Frittella 2019). The competence model fulfils a dual pedagogical purpose. On the one hand, it serves the purpose to analyse the interpreting product and process to identify the root cause of errors and the training needs of the individual trainee. On the other, it represents the foundation of the design of the skill-based training programme presented in this article. For the purpose of this article, the discussion will focus on the latter application of the model.

The competence model combines the *cognitivist* with the *functionalist* approach to the analysis of number interpreting, briefly discussed in the introduction. As represented in the figure below, the model describes number interpreting as a processing task unfolding on five levels – I) the number-word, II) the numerical information unit (NIU), III) the text, IV) the extralinguistic context, and V) the pragmatic function:

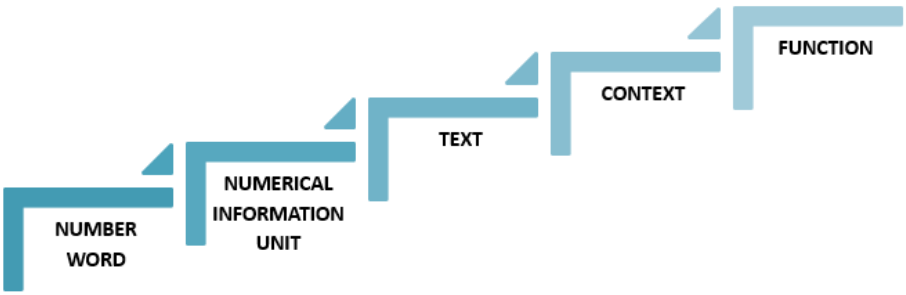

Figure 1: The levels of processing in the competence model of number interpreting as skilled performance

Different mental operations make it possible for the interpreter to process the input (the numerical information) on each level. Such cognitive processes can only be successful if the interpreter has mastered the underlying recurrent and non-recurrent skills. In the pedagogical application of the model, the recurrent

skills are called *skills* and the non-recurrent skills are called *techniques*[4], as can be seen in the representation of the competence model below. Errors systematically arise because of the failure in corresponding cognitive processes (Frittella 2017, 2019), pointing to a corresponding skill gap. This way, it is possible to identify trainees' needs through the analysis of their delivery.

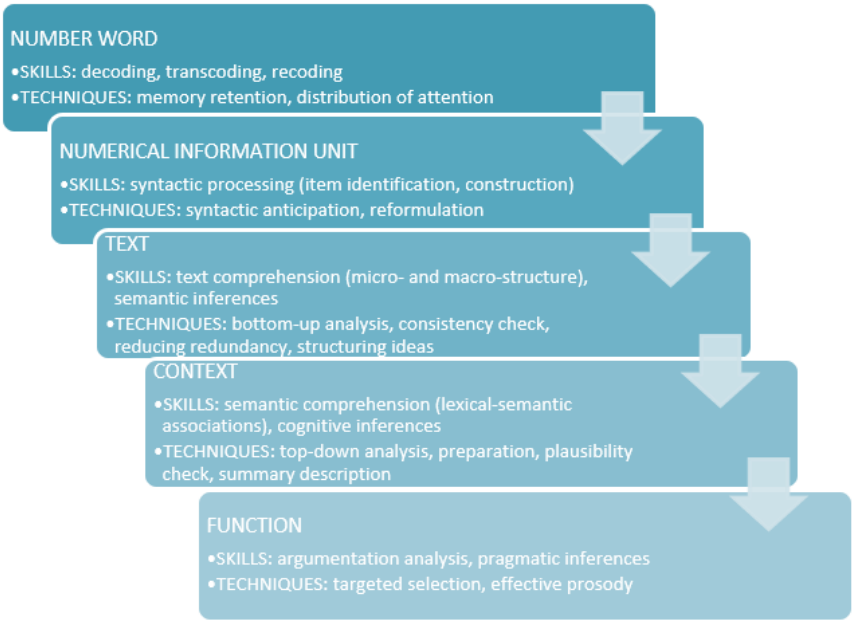

Figure 2: The competence model of number interpreting as skilled performance – recurrent and non-recurrent skills

Based on the distinction between recurrent and non-recurrent skills in cognitive psychology (van Merriënboer 1997), the difference between skills and techniques in the interpretation of numbers is the following. At each level of processing in the model, skills allow the interpreter to perform cognitive processes automatically that do not require cognitive control. The degree of automaticity of a given skill for the interpreter determines the speed of the processing task (*latency*), cognitive load and accuracy of the operations. Techniques, on the contrary, are consciously selected by the interpreter to (a) solve task-related problems promptly and efficiently, (b) overcome cognitive constraints, (c) achieve an intended outcome.

For instance, on level I, the cognitive processes of decoding, transcoding and recoding come into play in transforming the Italian number word 'trecentoqua-

4 Other works in the field of Interpreting Studies call non-recurrent skills 'interpreting strategies' (Kalina 2000; Kadel/Seubert 2015). Riccardi (2005) distinguishes *skill-based strategies* from *knowledge-based strategies*, where the first can be understood as recurrent skills and the second as non-recurrent skills.

rantacinque' into the Arabic number 345 and the English number word 'three hundred and forty-five'. A sufficient degree of automaticity of the corresponding skills allows the interpreter to perform these processes accurately, fluently and quickly. Techniques come into play in the selection of an adequate procedure to follow that makes it possible to overcome inherent constraints and accomplish the interpreting task. An effective technique on level I allows the interpreter to select the best procedure according to the limitations of short-term acoustic memory (Cowan 2010) and the characteristic of the information to be processed—i.e. is it a number in isolation or a dense text passage? Is it a small or a large number?

2. Proposal of a training programme for the SI of numbers

The theory outlined above served as the foundation of the constructivist skill-based training programme for the simultaneous interpretation of numbers presented hereafter. The training programme is defined as *skill-based* because the design process, from the modelling of the complex cognitive skill to the development of the training activities, was guided by research on ID for complex cognitive skill training. The programme is *constructivist* in that the design process was strongly influenced by the assumption that the training outcomes depend on the adequate cognitive and affective engagement of the trainees in the learning experience. Hence, to achieve the objective of effectively developing number-specific skills, the design of the training programme includes elements in support of trainees' motivation and metacognitive skills. The principle of *constructive alignment* (Biggs 1999) was used to achieve maximum consistency among the training objectives, the training activities and the assessment methods.

The overall structure of the training programme reflects the competence model of number interpreting as skilled performance (1.2). The training programme comprises five sessions, each of which addresses one level of processing and trains the inherent skills and techniques. Each session includes a class session and a training session, with exercises for autonomous practice at home[5]. Each session opens and closes with a self-assessment activity, consisting of an interpreting test and a retrospective questionnaire that guides trainees' evaluation of their strengths and weaknesses.

The aim of the *class session* is to provide the trainees with the knowledge that allows them to engage in meaningful learning processes, self-direct and regulate their practice at home, which includes:

a. *knowledge of assessment*: the participants learn to classify errors that may arise in the processing activity and link them to corresponding gaps in skills or techniques;

5 For feasibility reasons, in the present study each session was completed in approximately one week (see section 3). However, the results of the study highlight that this time frame may be too short. For this reason, the author is transforming the training programme into an online course for self-paced learning, as explained in the conclusion of the article.

b. *task knowledge*: the participants learn to model the task, explain its inherent cognitive processes, the skills involved and viable techniques;
c. *knowledge of the objectives*: the participants are provided with a model of expert performance at each level and set their objectives;
d. *knowledge of training methods and self-regulation*: the trainer highlights the link between objectives and training methods as well as the importance of reflection and self-regulation during learning.

In the class session, the trainer also helps the trainees apply such knowledge to identify their individual training needs. The trainer uses systematic feedback on sample exercises (involving highlighting patterns across participants) to support trainees' self-analysis, guide them on how to perform the exercises and in reflecting on meaningful aspects of the task.

In the *training session*, the trainees practise the skills and techniques that are the objectives of the session. Each training session comprises several types of exercises, each type corresponding to one precise objective. To encourage goal-directed practice, the training session opens with a *training plan*, which reminds the trainees of the link between exercise types and skills/techniques like in the example below:

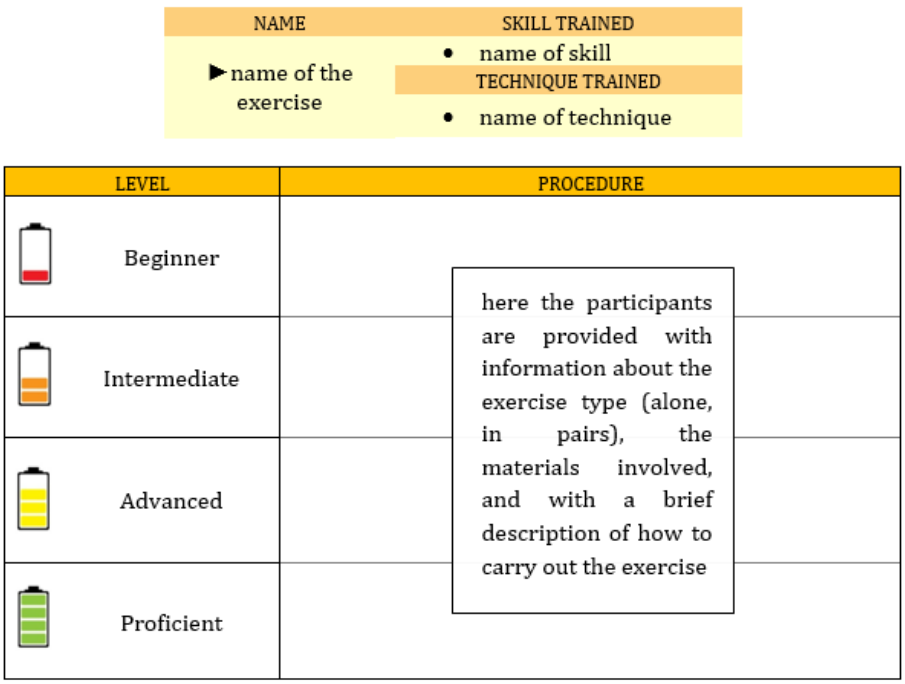

Figure 3: Example of the 'training plan' for one type of exercise in the first session

The design of the training activities is based on the description of the cognitive processes in the competence model of number interpreting. The exercise design includes both *part-whole* and *task-whole sequencing strategies* (see 1.1): the complex

skill is broken down into constituent skills initially trained in isolation, and each process is repeated at increasing difficulty (from beginners to proficient). For instance, when training decoding skills in session one, trainees are provided with recorded lists of number words and asked to visualise them as Arabic numbers, wait one second and only then "read out the number" from their mental representation. The difficulty is increased gradually by increasing the number of digits, the syntactic complexity of the SL number word, the speed of reading and reducing the time gap between one numeral and the next.

The exercise design also takes into account the different requirements of the acquisition of recurrent and non-recurrent skills. To facilitate the development of automaticity for recurrent skills, *restricted encoding* is used to enable the trainees to focus on individual processes in isolation, as in the above-mentioned example of training decoding skills. The training activities for techniques, instead, have a focus on promoting trainees' *mindful abstraction*. Several ID strategies are used to this aim, such as guided reflective activities accompanying the interpreting exercises. For instance, one of the objectives of session 4 is for the participants to develop a preparation technique for numbers. The training activities in this exercise type first provide the trainee with a structured procedure to follow (beginner's level). The degree of guidance is then gradually diminished and the amount of reflection and autonomous strategic thinking required to complete the task increases. In the next step, the trainees must complete a similar task based on 'key concepts' that give them hints on the relevant elements to focus on in their preparation. Then, they must prepare on an unrelated topic but are provided with a guided analysis of the context and the key concepts. Finally, they must apply their preparation technique without guidance. In this whole process, a reflective questionnaire helps trainees self-evaluate the effectiveness of their preparation technique. The questionnaire includes a checklist of relevant numerical information that the trainees should have searched for as well as questions aimed at helping them reflect on their approach to preparation and optimise their technique, such as:

- How did you plan your preparation and choose what to search for?
- What aspects of your analysis worked/what did not?
- How are you going to proceed next time?

In order to support meaningful learning processes during autonomous practice at home, the training programme includes a metacognitive tool called *trainee's manual*. The manual is a hybrid between a course syllabus, an exercise manual and a training journal inspired by research on the use of training journals and logbooks in interpreter training (Doğan *et al.* 2009; Lee 2015) and in other domains of expertise development (Tang 2002). It contains material to accompany the trainee in all stages of the learning process: self-assessment, goal-setting, self-regulation and reflection during the interpreting exercises. As a written record of trainees' progress over time, the manual also aims to encourage positive self-efficacy beliefs.

3. Participants and methods

To evaluate the consistency and effectiveness of the training programme, the study design drew on the *design-focused evaluation* (DFE) approach, developed by Calvin Smith (2008) to evaluate the effectiveness of the constructive alignment (Biggs 1999) of course design. DFE is a qualitative method primarily concerned with students' perception of the alignment of fundamental course components (the teaching-learning activities and assessment methods) with the learning objectives. Students' awareness of ID strategies facilitating the intended learning outcome is considered as evidence for the effectiveness and consistency of the course design (Smith 2008).

Given the difficulty of finding one large group of participants, two groups of students participated in the training programme. This choice also aimed to increase the *confirmability* (Bhattacherjee 2012) of the study, since it made it possible to determine whether the observation of the same phenomenon (the impact of the course design on the learning process) on two different groups of participants could lead to similar conclusions[6]. Given the difficulty of finding participants with homogeneous characteristics in the research time frame, the criteria for inclusion in the study were the following: a) language combination and directionality, b) previous interpreting experience, c) no previous systematic training in interpreting numbers, d) completion of at least 70% of the number seminar.

All study participants[7] were native speakers of Italian and the interpreting exercises were in English so that all were interpreting from their foreign language into their mother tongue. All participants in both groups declared that they had never undertaken systematic training on numbers before and that they regarded numbers as a major interpreting difficulty. The participants in the first group were five bachelor's students at the *Istituto Universitario di Mediazione Linguistica* in Perugia (Italy). They participated in the number seminar in the months of March and April 2017. At the time of the study, they were in their last bachelor's year in linguistic and cultural mediation, they had been studying consecutive interpreting for 3 semesters and simultaneous interpreting for 2. The second group consisted of five master's degree students of conference interpreting at the *Johannes-Gutenberg University* in Germersheim (Germany). They participated in the number seminar during the months of May and June 2017. At the time of participating in the seminar, they had been studying both consecutive and simultaneous interpreting for 4 semesters.

6 It is for this reason that the present study contrasts observations made on two groups of students despite their dissimilarities. The comparison should, hence, not be interpreted as an attempt to generalise the study conclusions.

7 Participation in the study was voluntary and the participants were guaranteed anonymity and confidentiality. They signed an informed consent form, in which they agreed to participate in data gathering throughout the seminar. They assigned themselves a pseudonym for the researcher to identify their data, as can be seen in the samples included in the present paper.

At the end of the seminar, the participants provided the author with their written feedback on whether they found the seminar useful, their perceived progress and what they found the most and the least helpful. The participants were told that their opinion was solely needed to improve the quality of the seminar not to compromise the authenticity of the responses (Ladkin 2017). They could keep their feedback anonymous but none of them chose this option.

Participants' feedback responses were analysed through qualitative *thematic analysis*. This method is commonly used to identify underlying concepts in unstructured qualitative data (Braun/Clarke 2006), such as the data gathered in this study. The analysis was conducted using the software QDA Miner. First, students' feedback was analysed to identify inductively the main themes. The themes were then categorised as follows: a) the perceived strengths of the course design, b) the perceived weaknesses, and c) participants' perceived progress, comprising the subcategories 'perceived improvement in the interpretation of numbers' and 'perceived improvement in participants' overall interpreting competence'. The figure below shows the hierarchy of the categories and sub-categories and the corresponding themes:

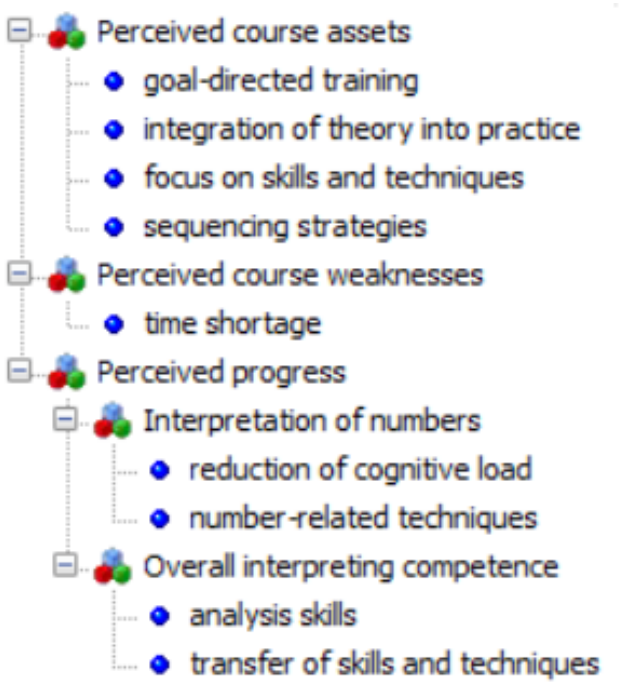

Figure 4: Themes grouped into categories for the thematic analysis of participants' feedback

Table 1 provides a detailed description of the themes:

Category	Code	Description
Perceived course assets	focus on skills and techniques	the structure focusing on precisely-defined skills/techniques with aligned exercises and assessment was a major strength of the training programme
Perceived course assets	goal-directed training	the goal-oriented training with targeted, gradual exercises was a major strength of the training programme
Perceived course assets	integration of theory into practice	the theoretical explaination accompanying practical training was a major strength of the training programme
Perceived course assets	sequencing strategies	the sequencing strategies were a major strength of the training programme
Perceived course weaknesses	time shortage	the short time frame for instruction and practice at home was the major weakness of the training programme
Perceived progress\Interpretation of numbers	number-related techniques	the participants felt that they acquired techniques to deal with number-related difficulties
Perceived progress\Interpretation of numbers	reduction of cognitive load	the participants felt that the cognitive load in the task of interpreting numbers reduced
Perceived progress\Overall interpreting competence	analysis skills	the participants found that their overall ability to analyse speeches during interpreting improved through the seminar
Perceived progress\Overall interpreting competence	transfer of skills and techniques	the participants reported that they could transfer the skills and techniques trained in the seminar to other interpreting tasks

Table 1: Description of the main themes identified in participants' feedback, divided by category

4. Results

Table 2 reports the number of occurrences of each theme in participants' feedback by the number of cases, i.e. showing how many participants mentioned each theme:

THEME	NO OF CASES
PERCEIVED COURSE ASSETS	
FOCUS ON SKILLS AND TECHNIQUES	5
GOAL-DIRECTED TRAINING	6
INTEGRATION OF THEORY INTO PRACTICE	3
SEQUENCING STRATEGIES	4
PERCEIVED COURSE WEAKNESSES	
TIME SHORTAGE	7
PERCEIVED PROGRESS	
INTERPRETATION OF NUMBERS	
REDUCTION OF COGNITIVE LOAD	5
NUMBER-RELATED TECHNIQUES	6
OVERALL INTERPRETING COMPETENCE	
ANALYSIS SKILLS	4
TRANSFER OF SKILLS AND TECHNIQUES	9

Table 2: Distribution of themes in participants' feedback by the number of cases

The chart below shows the distribution of the themes by the number of cases sorted in descending order:

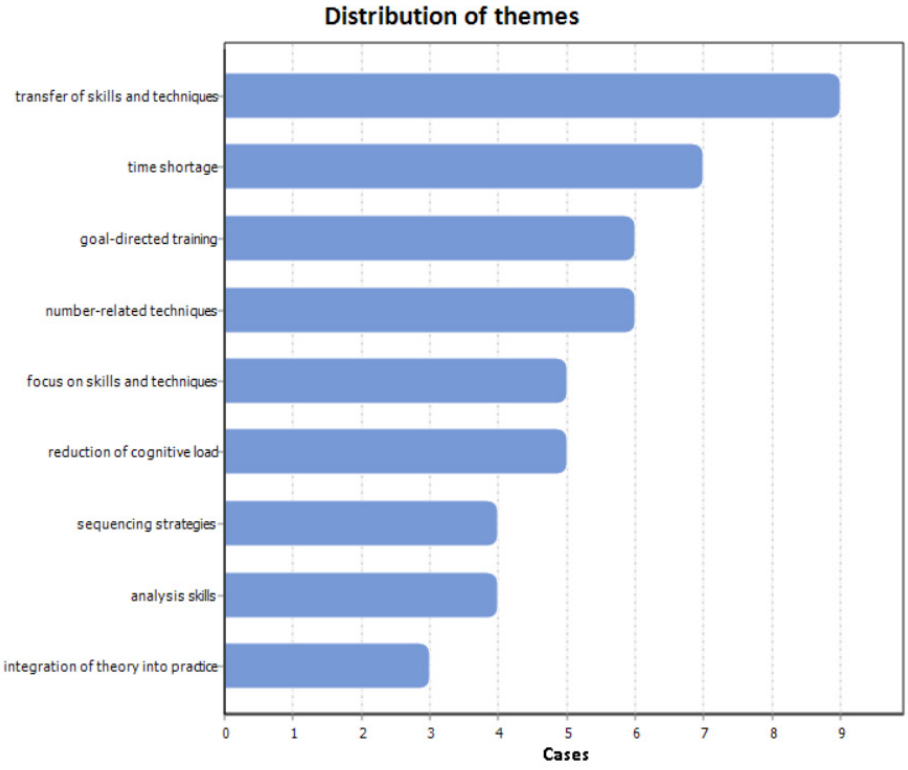

Figure 5: Column chart representing the distribution of themes by the number of cases

5. Discussion

The frequency of the themes in participants' feedback responses highlights the instructional design strategies that, in their opinion, most supported their learning process, the main weakness in the training programme and the perceived training outcomes. An in-depth analysis points to possible links between the ID strategies underpinning the training programme and their impact on participants' learning, and lead to hypotheses on the effectiveness of the design practices under investigation. While the value of these hypotheses must still be established empirically, they may stimulate further inquiry into instructional design principles for conference interpreter training.

Starting from the perceived assets of the course design, the following characteristics were identified as supportive of the learning process: the goal-centred, systematic training approach (6 participants), the explicit instruction on skills and techniques (5 participants), the sequencing strategies used to design the

training activities (4 participants), the background "theoretical" knowledge provided before the training session (3 participants):

> The fact that the exercises of each type are divided into various levels allowed us to focus on our needs: on the problems that caused us the most difficulties, and [on the activities] that could best help us achieve a specific goal and [improve at] each step before moving on to the next one. In my opinion, it is very important to divide such a complex process into many steps that, when worked on one by one, make it possible to achieve tangible results – Gina, MA

The participants also linked these ID elements to an improvement in their awareness of effective training practices and the importance of *self-regulation* in the learning process:

> The theoretical concepts were fundamental as well to understand the purpose of training and the best way to achieve the desired results… Even if before I did not understand the importance of this, the seminar made me realise how vital it is to practise methodically, which, now I know, leads to great results – Sally, MA

Seven participants stated that the above-mentioned elements enabled them to track their progress over time and identify the correlation between training quality and outcome. They declared that this, on the one hand, motivated them to persevere in their learning efforts and, on the other hand, reinforced their self-efficacy beliefs:

> I was always motivated to move forward because I was curious to see my limits on the various levels, and I found it smart to proceed step by step with a structured method – Margherita, BA
>
> You never feel overwhelmed because you start from the basics and slowly start reaching specific goals. … The course showed me that, with the right means, the theory, the targeted exercise, the right objectives and the time each person needs, anyone can achieve good results – Gina, MA

Moving on to the perceived weaknesses of the training programme, 7 participants mentioned that the time frame of instruction was too short. They explained that this limited their engagement in the training activities and, hence, their effectiveness. As discussed at the end of this section, the time constraints may be, indeed, considered as one of the main limitations of this study. To overcome this limitation, the author is currently developing an online course for number interpreting, based on the research findings presented in this article.

Coming to the perceived outcomes of training, 9 participants explicitly reported a perceived improvement in their ability to interpret numbers. Such improvement was identified as a reduction of the cognitive load in number-related processing tasks by 5 participants:

> [the systematic training approach] allowed me to "train" and accustom my brain to actions that previously required a greater effort, such as the decoding and recoding of numbers. As the course proceeded, the complexity of the tasks increased but the previous difficulties seemed to have been overcome through training – Carolina, BA

6 participants identified the improvement in their ability to interpret numbers as the selection and application of techniques to overcome task-related constraints, difficulties and/or attain desired results:

> finding the logical thread of the speech, matching data to the right referents, avoiding internal contradictions or errors of implausibility, etc. – Margherita, BA

The improved awareness of techniques may be considered as an important result because it represents the first step in the acquisition process (van Merriënboer 1997). It also gains in importance in the light of previous research, which identified a link between participants' low awareness (metacognitive knowledge) of viable techniques for numbers and their errors (Frittella 2017, 2019). For instance, some participants felt that the seminar helped them develop a systematic preparation technique "not only for the interpretation of numbers but for the preparation of any interpreting assignment" (Sally MA). This may represent an important achievement considering that, without specific instruction, interpreting trainees may not be aware of the need to fill their gaps in relevant *encyclopaedic numerical knowledge* during preparation in order to ease comprehension and prevent plausibility errors in the interpretation of numbers (*ibid.*).

9 participants felt that their interpreting-general competence improved through the training programme. 4 participants defined this improvement as their improved ability to analyse the source speech, select and prioritise information. 9 participants also reported that they could transfer the skills trained in the seminar to other interpreting tasks, modes and language combinations, such as to consecutive interpreting from German into Italian.

According to the design-focused evaluation approach, participants' awareness of the way specific design elements supported their learning is an indicator of their effectiveness in supporting desired learning processes. Therefore, the analysis of participants' feedback may lead to hypotheses on the interrelation between instructional design principles and their impact on trainees' learning process. As explained in the second section of the present article, the training programme under investigation presents a *skill-based* structure, in which the nature and hierarchy of the skills inherent in the SI of numbers determined the selection of the teaching-learning activities and the sequencing strategies chosen to design the training materials. The principle of *constructive alignment* was used to ensure the consistency among all course elements, and the trainees were made aware of the link between each skill/technique and the corresponding exercise – between the objective and the means to obtain it. In their feedback, the participants reflected on the positive impact of such a systematic approach on their ability to analyse themselves, set their goals and train with a clear focus on achieving specific objectives. In other words, the design of the training programme, combined with the preliminary theoretical explanation, may have supported participants' self-assessment and self-regulation skills. This leads to the hypothesis that a combination of these ID principles and strategies may be effective in designing training programmes to support interpreting trainees' metacognitive skills.

Previous studies highlighted the importance of linking interpreting trainees' performance to unstable factors within their control (Wu 2016) and providing

them with clear guidance on how to fill their skill gaps (Takeda 2010). The participants in the present study reported a motivating effect deriving from the awareness of the objectives and the training activities that were most adequate to achieve them. Further research could explore the potential of criterion-referenced training programmes to support interpreting trainees' motivation and self-efficacy beliefs.

It is noticeable that 9 in 10 participants explicitly mentioned the transfer of skills/techniques from the context of training to other interpreting tasks. This high potential for transfer may be due to the dedicated instruction on skills and techniques during the study, which clarified to the participant general theoretical principles and guided them to apply them in the training sessions. Several studies have shown before that interpreting trainees tend to use a technique more often if this is explicitly addressed by their trainer (see for instance Li 2013). The hypothesis that could be further explored moving from the observation reported above, is that explicit, systematic instruction may also facilitate the transfer of skills from the context of training to unrelated interpreting tasks.

Coming to addressing the limitations of the present study, it must be stressed once again that it should be intended as an exploratory study aiming to open new paths for instructional design research in interpreting pedagogy. The analysis results cannot be regarded as generalisable and a number of limitations can be identified in the study design. The main limiting factors are the small number of participants (as is often the case in interpreting research as well as in in-depth qualitative studies in education) and the limited time frame of instruction, determined by the difficulty in finding an adequate context to test the training programme. Given the short time available to complete the training programme, the participants could not obtain the extensive practice needed to achieve the automaticity of the several skills and techniques presented in the seminar, which affected negatively the overall effectiveness of training. What is more interesting for the purpose of the present analysis is that the limited time available may have also affected participants' perception of the effectiveness of individual training strategies, such as the trainee's manual, which was mentioned in only two responses. The effectiveness of guided reflective practice supported by metacognitive tools remains to be explored systematically.

6. Conclusion

Interpreting is a practical activity that implies the mastery of a complex system of cognitive skills. Some believe that interpreter education should reflect the practical nature of this activity and be based on what has been called by Pöchhacker (2010) the "master-apprentice model". This is a minimally-guided teaching approach in which students are expected to master the skills involved in the interpreting task merely by trial and error (Takeda 2010). However, considering the complexity of skill acquisition and the several factors that influence the effectiveness of instruction, it is questionable whether minimally-guided approaches may actually deliver better training outcomes than systematic training.

The present article argued that instructional-design research may be a possible way to increase the quality of conference interpreting training courses. The empirical basis for the discussion was the systematic training programme developed by the author for the simultaneous interpretation of numbers – a common stumbling block for interpreters, for which no comprehensive training methodology had been yet developed. The article, then, explored the impact of the instructional design strategies underpinning the training programme on participants' learning process. The study was designed using the approach of design-focused evaluation (Smith 2008), hence, focusing on students' perception of the course design. The training programme was tested on two groups of interpreting trainees (10 in total, 5 BA and 5 MA). Their unstructured feedback was analysed qualitatively by the thematic analysis. The themes emerging from the analysis were grouped into three categories: perceived training outcomes, perceived strengths and weaknesses in the course design.

9 participants explicitly reported an improvement in their ability to interpret numbers through the training programme; in particular, they reported the reduction of the processing requirements of number-related interpreting tasks (5 participants) and the increased awareness of viable techniques to reduce the cognitive load in interpreting numbers, overcome task-related difficulties and achieve desired outcomes (6 participants). The improved awareness of techniques gains in importance in the light of previous research (Frittella 2019), which identified a correlation between participants' low awareness (metacognitive knowledge) of techniques and their errors in the interpretation of numbers. Furthermore, nearly all participants reported a positive impact of the training programme on their general interpreting competence. 4 participants believe that they could improve their analysis skills and 9 of them reported that they had been able to transfer the skills and techniques trained in the seminar to other interpreting tasks, modes and language combinations. Although further research is needed to confirm these conclusions, these observations may be promising, as they lead to the hypothesis that a systematic training methodology may support the acquisition not only of *one* skill but also of *interpreting-general*, *transferable* skills. It is possible, therefore, that skill-based training on numbers may turn this common *problem trigger* into a useful *training tool*, capable of supporting trainees' overall development of interpreting competence. The analysis also led to the hypothesis that systematic training, with dedicated instructional design strategies, may be effective in developing trainees' metacognitive skills and supporting their motivation as well as their self-efficacy beliefs. Overall, the analysis supports the view of previous studies that systematic training is more effective than minimally-guided approaches in fulfilling the primary purpose of formal interpreter education: "to help individuals who wish to become professional interpreters […] develop their interpreting skills more rapidly than they could through field experience and self-instruction" (Fan 2012: 1).

The main limitation identified was the short time available for instruction and training. To overcome this limitation, the author of the present article is currently developing an online course for number interpreting based on the research findings presented in this article. The fundamental structure of the course

remains unchanged. The course, based on five levels, addresses skills and techniques directly and provides guidance for their acquisition and successful implementation. It has a strong focus on self-analysis and self-regulation: it guides participants' ongoing self-feedback and helps them engage in meaningful practice. Differently from the previous course, the online training module allows participants to set the pace of their learning and to complete the course independently of their location. Furthermore, the course will be provided at different difficulty levels to suit different levels of expertise.

Given the limitations of the present study, addressed in detail in the discussion of the results, the observations made cannot be regarded as generalisable. However, the author believes that the present discussion highlighted the potential of instructional design research to advance the current state of interpreting pedagogy. The hypotheses advanced in the present article, as well as the theoretical framework presented, may be instrumental in stimulating further scientific inquiry into generalisable principles for the development of systematic conference interpreter training programmes. Instructional design research may open a new stage in the integration of interpreting theory/research into teaching practice. Entering this new stage, interpreter education may make a decisive step towards completing the shift from anecdotal to truly systematic, research-based teaching methodology.

References

Anderson J. R. (2004) *Cognitive Psychology and its Implications*, New York, Worth.

Bandura A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory*, Englewood Cliffs, NJ. Prentice-Hall.

Bhattacherjee A. (2012) "Social Science Research: Principles, methods, and practices", *Global Text Project* (University of South Florida), Textbooks Collection 3, 1-140.

Biggs J. (1999) "What the student does: Teaching for enhanced learning", *Higher Education Research & Development* 18/1, 57-75.

Biggs J. B. / Tang C. (2007) *Teaching for Quality Learning at University: What the Student Does*, Maidenhead, McGraw Hill.

Black P. / Wiliam D. (2009) "Developing the theory of formative assessment", *Educational Assessment, Evaluation and Accountability* 21/1, 5-31.

Braun S. / Clarici A. (1996) "Inaccuracy for numerals in simultaneous interpretation: Neurolinguistic and neuropsychological perspectives", *The Interpreters' Newsletter* 7, 85-102.

Braun V. / Clarke V. (2006) "Using thematic analysis in psychology", *Qualitative Research in Psychology* 3/2, 77-101.

Cappelletti M. / Jansari A. / Kopelman M. / Butterworth B. (2008) "A case of selective impairment of encyclopaedic numerical knowledge or 'when December 25th is no longer Christmas day, but '20+5' is still 25' ", *Cortex* 44/3, 325-336.

Černov G. V. (2004) *Inference and Anticipation in Simultaneous Interpreting: A Probability-Prediction Model*, Amsterdam/Philadelphia, John Benjamins.
Cowan N. (2010) "The magical mystery four: How is working memory capacity limited, and why?", *Current Directions in Psychological Science* 19/1, 51-57.
Dingfelder Stone M. (2015) "(Self-)study in interpreting: Plea for a third pillar", in D. Andres / M. Behr (eds) *To Know How to Suggest …: Approaches to Teaching Conference Interpreting*, Berlin, Frank & Timme, 243-255.
Dodds J. / Gran L. (1989) *The Theoretical and Practical Aspects of Teaching Conference Interpretation: First International Symposium on Conference Interpreting at the University of Trieste*, Udine, Campanotto Editore.
Doğan A. / Arumi-Ribas M. / Mora-Rubio B. (2009) "Metacognitive tools in interpreting training: A pilot study", *Edebiyat Fakültesi Dergisi / Journal of Faculty of Letters* 26/1, 69-84.
Fan D. (2012) *The Development of Expertise in Interpreting through Self-Regulated Learning*, PhD thesis, School of Modern Languages, University of Newcastle.
Frittella F. M. (2017) *Numeri in interpretazione simultanea. Difficoltà oggettive e soggettive: un contributo sperimentale* (in English, *Numbers in Simultaneous Interpreting. Objective and Subjective Difficulties: An Experimental Study*), Rome, Europa Edizioni.
Frittella F. M. (2019) "70.6 billion world citizens: Investigating the difficulty of interpreting numbers", *Translation & Interpreting* 11/1, 79-99.
Kader S. / Seubert S. (2015) "Anticipation, segmentation … Stalling? How to teach interpreting strategies", in D. Andres / M. Behr (eds) *To Know How to Suggest …: Approaches to Teaching Conference Interpreting*, Berlin, Frank & Timme, 125-44.
Kalina S. (2000) "Interpreting competences as a basis and a goal for teaching", *The Interpreters' Newsletter* 10/1, 4-32.
Ladkin, S. (2017) "Exploring unequal power relations within schools: The authenticity of the student's voice", *Journal of Initial Teacher Inquiry* 38/3, 37-40.
Lamberger-Felber H. (2001) "Text-oriented research into interpreting: Examples from a case-study", *Hermes* 26, 39-63.
Lee Z. Y. (2015) *The Reflection and Self-Assessment of Student Interpreters Through Logbooks: A Case Study*, PhD Thesis, Heriot-Watt University, School of Management and Languages.
Li X. (2013) "Are interpreting strategies teachable? Correlating trainees' strategy use with trainers' training in the consecutive interpreting classroom", *The Interpreters' Newsletter* 18, 105-128.
Mazza C. (2001) "Numbers in simultaneous interpretation", *The Interpreters' Newsletter* 11, 87-104.
Mead P. (2015) "Numbers" in F. Pöchhacker / N. Grbić / P. Mead / R. Setton (eds) *The Routledge Encyclopedia of Interpreting Studies*, London, Routledge, 286-288.
Motta M. (2016) "A blended learning environment based on the principles of deliberate practice for the acquisition of interpreting skills", *The Interpreter and Translator Trainer* 10/1, 133-149.
Ohlsson S. (1993) "The interaction between knowledge and practice in the acquisition of cognitive skills" in S. Chipman / A. Meyrowitz (eds) *Foun-*

dations of Knowledge Acquisition: Cognitive Models of Complex Learning, Boston, MA, Springer US, 147-208.
Pinochi D. (2009) "Simultaneous interpretation of numbers: Comparing German and English to Italian. An experimental study", *The Interpreters' Newsletter* 14, 33-57.
Pöchhacker F. (2010) "The role of research in interpreter education", *Translation & Interpreting* 2/1, 1-10.
Riccardi A. (2005) "On the Evolution of Interpreting Strategies in Simultaneous Interpreting", *Meta* 50/2, 753-767.
Schott F. / Seel N. M. (2015) "Instructional design" in J. Wright (ed.) *International Encyclopedia of the Social & Behavioral Sciences*, Oxford, Elsevier Science, 196-200.
Schunk D. / Zimmerman B. J. (2008) *Motivation and Self-Regulated Learning: Theory, Research, and Applications*, New York, Routledge.
Schunk D. / Zimmerman B. J. (2008) "Motivation: An essential dimension of self-regulated learning" in D. Schunk / B. Zimmerman (eds) *Motivation and Self-Regulated Learning: Theory, Research, and Applications*, New York, Routledge, 1-30.
Setton R. (2010) "From practice to theory and back in interpreting: The pivotal role of training", *The Interpreters' Newsletter* 15, 1-18.
Smith C. (2008) "Design-focused evaluation", *Assessment & Evaluation in Higher Education* 33/6, 631-645.
Speelman C. P. / Kirsner K. (2005) *Beyond the Learning Curve*, Oxford, Oxford University Press.
Takeda K. (2010) "What interpreting teachers can learn from students: A case study", *Translation & Interpreting* 2/1, 38-47.
Tang C. (2002) "Reflective diaries as a means of facilitating and assessing reflection", *Quality Conversations: Proceedings of the 29th HERDSA Annual Conference Perth*.
van Merriënboer J. J. (1997) *Training Complex Cognitive Skills: A Four-Component Instructional Design Model for Technical Training*, Englewood Cliffs, NJ. Educational Technology Publications.
van Merriënboer J. J. / Jelsma O. / Paas, Fred G. W. C. (1992) "Training for reflective expertise: A four-component instructional design model for complex cognitive skills", *Educational Technology Research and Development* 40/2, 23-43.
van Merriënboer J. J. / Sweller J. (2005) "Cognitive Load Theory and complex learning: Recent developments and future directions", *Educational Psychology Review* 17/2, 147-177.
Wu Z. (2016) "Towards understanding interpreter trainees' (de)motivation: An exploratory study", *Translation & Interpreting* 8/2, 13-25.
Zimmerman B. J. (2002) "Becoming a self-regulated learner: An overview", *Theory Into Practice* 41/2, 64-70.