# SIGN LANGUAGE AND MOTOR LEARNING

# LINGUA DEI SEGNI ED APPRENDIMENTO MOTORIO

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**ABSTRACT**

The aim of the contribution is to illustrate the link between sign language learning and neuroscience, through the concept of motor and therefore coordinating learning.
Through a pilot project, we have tried to understand how the coordination aspects have a more or less marked impact on language learning and consequently on the motor learning carried out through it.

L'obiettivo del contributo è illustrare il legame esistente tra l'apprendimento della lingua dei segni e le neuroscienze, attraverso il concetto di apprendimento motorio e dunque coordinativo. Attraverso un progetto pilota si è cercato di comprendere come gli aspetti coordinativi incidano in maniera più o meno marcata sull'apprendimento della lingua e di conseguenza sull'apprendimento motorio effettuato attraverso di essa.

**Introduction**

In the delicate interplay between neuroscience and non-verbal communication, the general concept of learning and consequently that of motor learning, is particularly interesting. As mentioned earlier in the field of non-verbal communication, the concept of motor learning connected to that whole non-linguistic communicative area (posture, gestures and signs), seems apparently to be a fertile ground for research. Studies that combine motor learning and nonverbal communication seem to be rather heterogeneous, although in principle it is possible to group them into some specific macro areas. First of all, there is a copious point of view linked to the purely psychological and cognitive aspects of non-verbal communication (Bramlett, 2020), then passing through a purely motor of learning (Moliterni, 2014), finally, to find the trade union of the strands first described, in the languages marked and specifically of the Italian sign language (Roccaforte, 2018). And it is precisely in this area of sign language that the contributions on the subject of sign language learning seem to be limited as a purely motor learning, an area in which this research project will be included. The aim of the contribution will be to demonstrate the link between the learning of sign language or rather of a marked language and its more explicitly motor part, linked mostly to the acquisition of the signs themselves, by the global and postural movement, intrinsically connected and at the basis of future language-related communication. So after reviewing the literature of the case and the main interventions and specific contributions of the theme, the idea is to analyze how important and also overlapping and usable, the purely coordinating aspect that underlies every type of motor learning and therefore also signs. By first administering a questionnaire to a class of students at level A2 of a course Lis - Italian Sign Language (pilot project), he moved and then proposed the questionnaire itself to a team of students at the Interpreter level. Therefore, we tried to verify if the techniques and knowledge coming from the motor and sports field could be superimposed and reusable to learn the signs of the marked language, quickly and incisively.

**Literary background**

The sources consulted and used for this project were divided into preliminary, primary and secondary. Contributions related to the last five years  were taken into account, starting from 2017-2018, with some exceptions. Among the preliminary sources were consulted mainly partly specialized websites, which tend overall to summarize the chosen theme through three clear points of view particularly useful. On the one hand, there are points of research purely related to motor work and therefore related to the learning of the motion gesture in terms of coordination skills (2023,www.scienzemotorie.com, https://www.scienzemotorie.com/processi-e-fasi-dell-apprendimento-motorio/).

There are still preliminary sources that deal with the purely semantic aspects (2021,www.sinapsicoaching.com,https://sinapsicoaching.com/comunicazione/comunicazione-non-verbale/)or cognitive - psychological (2017, www.divulgazionedinamica.it,https://www.divulgazionedinamica.it/blog/elementi-della-comunicazione-non-verbale/)of non-verbal communication. Finally there are contributions in some specialized sites that highlight only technical aspects of marked languages and everything related to the deaf world (Ente nazionale sordi, National Deaf Body, 2023). Different is the discourse of primary sources where we find the main studies and researches in the field of motor learning, marked languages and aspects of non-verbal communication. A first address of such sources basically emphasizes how, both in the context of marked languages and non-verbal communication, the visual aspect - gestural (Giuliano B., Quartana G., 2018) and therefore purely coordination oculo - manual and mimic skills - gestural (Colella D., 2015) are fundamental for a perfect success of non-verbal communication. To further support these hypotheses is also the work of Aiello (2012) in which it is argued that the movement is the basis for every type of language learning. Another point of view of these sources concerns the semantic aspects related to the meaning of communication and non-verbal communication. Nonverbal communication always has a multi-mode component (Mignosi E., 2020), component that sees the meaning of a communication go mainly through the motor and non-verbal aspects. In the wake of what has just been said is the work of Sgambelluri (2017); the body performs cognitive and social functions simultaneously, becoming the trade union for the entire communication process. These sources reinforce and update the styles enunciated by Watzlawick on the whole communicative process and the pragmatic communication (1978).

Watzlawick's work leads back to secondary sources where we find mainly manuals and texts related to the themes mentioned above. Significant are the contributions related to motor learning (Biino V., 2021), (Galfo L., 2022),to marked languages (Murolo J., 2018), and to non-verbal communication (Pazienza V., 2020).

**Methodology and methods**

The contribution is part of the descriptive research and the methodology adopted was, as already mentioned, the administration of a questionnaire based on the Likert scale, with the following possibilities of response: fully agree, agree, indecisive, disagree, strongly disagree. The problem analyzed in the neuroscience and learning relationship was the study of marked languages and specifically the motor learning of Italian sign language. The research questions followed the following scheme: Is it possible to learn sign language by understanding this marked language as any motor learning? Is it possible then to standardize such motor sign learning as any motor learning? Is it possible to superimpose the aspects of nonverbal communication on the non-manual components (NMC) of sign

language? Finally, can motor learning and all the coordination aspects related to it help the learning of marked languages? To verify these hypotheses, that is, whether there is an overlap of time and dynamics in the learning of marked languages exactly as described in the model of Meinel and Schnabel (1977), we proceeded through the following steps. First, a questionnaire was administered to students of an Italian sign language course - Lis - level A1/A2, a sample of 6 units, equally divided by gender (3 males, 3 females), aged between 19 and 50, with an average age of 35(pilot project).The respondents, after replying to the items, suggested changes and changes to the questionnaire itself. The research then proceeded by administering the new questionnaire to a sample of 10 units, all equally distributed for gender differences (5 males and 5 females), belonging to an Italian sign language course - Lis, of Interpreter level, placed beyond the scale of the C2 language level, with an average age of 39 years. The questionnaire included 10 items, so composed, all as previously mentioned in line of relevance to the Likert scale: to learn a marked language it is essential to learn to coordinate multiple body movements together.

1. In order to learn a marked language, it is essential to learn how to sequence signs.

2. To learn a marked language it is essential to learn how to manage the right amount of strength in order to accurately perform the signs.

3. In order to learn a marked language, it is essential to learn to start the sign as quickly as possible.

4. In order to learn a marked language, it is essential to learn to adjust and modify the specific time and rhythm of each sign.

5. To learn a marked language is fundamental, maintain a stable spatial orientation, in reference to the sign that is unfolding.

6. In order to learn a marked language, it is essential to know how to make your own movements that you were not able to do before.

7. In order to learn a marked language, it is essential to organize the signs in advance, in order to correctly realize the signs themselves.

8. In order to learn a marked language, it is essential to modify, if necessary, the sign that has just begun, to cope with unforeseen situations.

9. To learn a sign language it is essential to organize the signs in advance, so as to correctly realize the signs themselves.

10. To learn a sign language it is essential to change , if necessary, the sign just started, to cope with unforeseen situations.

**Results and data discussion**

So for what concerns the results we will review the data for each item. At question number 1, 53.8% of the sample fully agrees with the initial statement and 46.2% agrees. There are no undecided or conflicting opinions.

1. To learn a marked language you need to learn to coordinate multiple body movements togheter.



1. PER APPRENDERE UNA LINGUA SEGNATA È FONDAMENTALE IMPARARE A COORDINARE PIU' MOVIMENTI DEL CORPO INSIEME.

- PIENAMENTE D'ACCORDO
- CONCORDO
- INDECISO
- IN DISACCORDO
- FORTEMENTE IN DISACCORDC
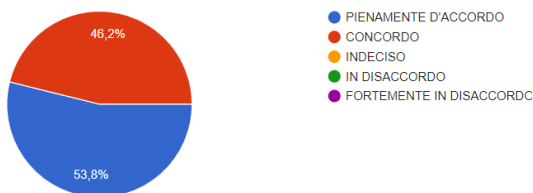
Graph. 1(Combination of movements and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

As for the discussion of the results obtained, the first item contains practically the whole sample that agrees or is fully in agreement with the initial statement. This could imply that to learn a marked language it is essential to coordinate multiple movements together; torso, hands passing through the movements of the head and not least facial expressions. Apparently this item is perfectly in line with the initial assumptions.

As regards question 2, 61.5% are in full agreement and another 38.5% agree. Here, too, there are no uncertainties or disagreements.

2. To learn a marked language it is essential to learn to relate the movements of the superior arts, including the hands, with the visual field.
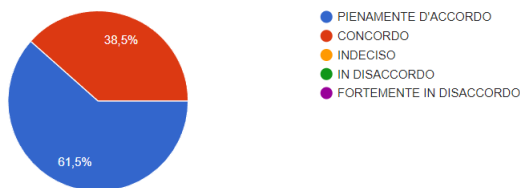
Graph.2 (Time space-focus and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

In this item most of the sample agrees that it is essential to relate the movements of the upper limbs and therefore of the hands to the field of view. This factor highlights the importance of eye coordination - manual and visual - spatial (Giuliano B., Quartara G., 2018) in a manner consistent with the previously illustrated research hypotheses. On the third item, number 3, 53.8% agree, 23.1% agree fully, 15.4% are undecided and 7.7% disagree.

3. To learn a marked language it is essential to learn how to sequentially sort the signs.
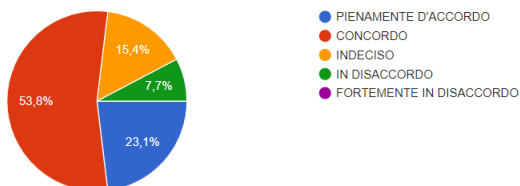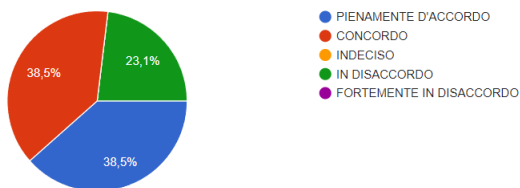


Graph. 3 (Motor differentiation and marked languages )
*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

In the fourth item, number 4, 38.5% are in full agreement with another 38.5% who agrees, while 23.1% disagree. There are no undecided or strong disagreements.

4.To learn a marked language it is essential to learn how to manage the right amount of strength in order to accurately perform the signs.

**Graph. 4 (Motor differentiation and marked languages)**

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

Even at the third item most of the sample 76.9% seems favorable to the initial statement. This would imply from the point of view of coordination to differentiate in a relevant way the movement over time, factor that added to 77% of favorable of item number 4, would confirm the choices of item number 3 adding value to what is affirmed; to "mark" correctly it would seem fundamental to differentiate from a coordinating point of view the right amount of muscle strength to accurately perform the signs , at the right time. It is also true though that between 3 and 4 items there is a 30.8% of respondents disagreeing with both statements. This data would logically imply that the coordinating factors linked to motor differentiation are not relevant to the learning of a marked language and therefore to the correct execution of the signs themselves. With reference to the initial assumptions, these items are still relevant to them, albeit with an important opposition. Item number 5 has 69.2% disagreement, followed by 15.4% full agreement. There is 7.7% agreement and yet another 7.7% undecided. No one strongly disagrees.

5.to learn a marked language it is essential to learn how to start the sign as quickly as possible.
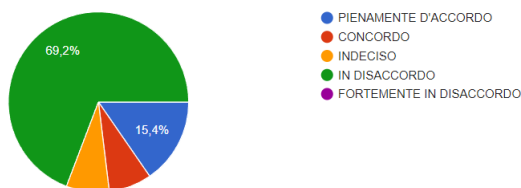
**Graph. 5 (Movement anticipation and marked languages)**

As for item number 5, the majority of the sample (69.2%) does not consider it important and therefore fundamental for learning the marked languages to start a sign as quickly as possible. This data implies that the coordinating aspect that underlies the capacity for reaction and anticipation is not peremptory and priority in the execution of the sign itself. It's obvious that the data is not overlapping with the initial assumptions. The sixth question, number 6, sees 46.2% fully agree, followed by 38.5% agree and 15.4% undecided. No one disagrees or strongly disagrees.

6. To learn a sign language it is essential to learn to adjust and change the specific time and rhythm of each sign.

6. PER APPRENDERE UNA LINGUA SEGNATA È FONDAMENTALE IMPARARE AD ADEGUARE E MODIFICARE IL TEMPO E IL RITMO SPECIFICO DI OGNI SEGNO.



- PIENAMENTE D'ACCORDO
- CONCORDO
- INDECISO
- IN DISACCORDO
- FORTEMENTE IN DISACCORDO
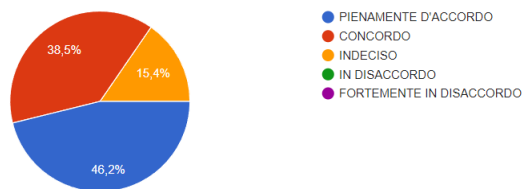
Graph. 6 (Rhythm skills and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

On the sixth question 84.7% of the sample is in favor (agrees/fully agree) that the pace at which to mark is of fundamental importance for learning a marked language. This aspect is in line with what is defined in the literature as time of communication, as a pivotal element of paraverbal communication (Watzlawick, 1978), along with tone and volume. Apparently, therefore, even in this item the sample turns in a coherent way towards the starting hypothesis. This is also supported by the fact that the remaining 15.4% is undecided since there is no one in opposition (in disagreement/strongly disagreement). In the seventh item, number 7, the majority of the sample is in favor of the statement; 38.5% are in full agreement or agree (38.5%). 15.4% disagree while 7.7% are undecided. None strongly disagree.

7.To learn a sign language, it is essential to maintain a stable spatial orientation, in reference to the sign that is unfolding.

7. PER APPRENDERE UNA LINGUA SEGNATA E' FONDAMENTALE, MANTENERE UN ORIENTAMENTO SPAZIALE STABILE, IN RIFERIMENTO AL SEGNO CHE SI STA SVOLGENDO.
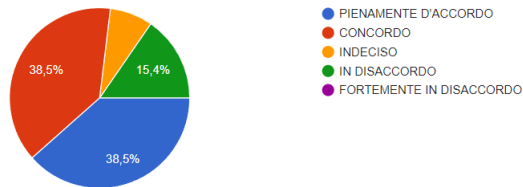


Graph. 7 (Ability to balance and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

At 7% item 77% of the sample agrees with the initial statement. 15.4% disagrees with 7.7% is undecided. In this case too, 77% of those in favor suggest that it is essential to mark, to maintain a stable spatial orientation. All this is technically adherent to the so-called "quadrant" of the sign, that imaginary space above the line of the navel and below the chin, formed by the width of the shoulders, where precisely to mark. It is not however to underestimate the percentage of contraries and undecideds, in all 23,1%, that sees the hypotheses only pertaining superimposable to the data. At question number 8, 30.8% of the sample agrees, as do the undecided with 30.8%. 23.1% agree with the starting item, while 15.4% disagree. No one strongly disagrees.

8.It is fundamental to know how to make own movements that before you were not able to realize.

8. PER APPRENDERE UNA LINGUA SEGNATA È FONDAMENTALE SAPERE FARE PROPRI DEI MOVIMENTI CHE PRIMA NON SI ERA IN GRADO DI REALIZZARE.
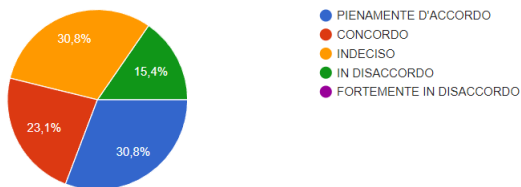


Graph. 8 (Motor learning and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

The data of the eighth item are particularly discordant; 53.9% are in favor of the statement while 47.2% are in disagreement or indecisive. This implies for this item that has as theoretical reference the general coordination ability of motor learning (Biino V., 2021), an in-depth discussion. About half of the sample believes that in order to learn a marked language, it is necessary to learn new movements (signs and all that follows) that they previously did not have and were able to achieve. The other half of the sample apparently considers that these movements are already in the possession of the "teachers" and therefore other factors are necessary and determining to learning. Thus hypothesis partially overlapping with the data. Item number 9 sees most of the sample in full agreement (46.2%), followed by 23.1% agreeing and 23.1% undecided. 7.7% disagree. None strongly disagree.

9.To learn a sign language it is essential to organize the signs in advance, so as to correctly realize the signs themselves.

9. PER APPRENDERE UNA LINGUA SEGNATA E' FONDAMENTALE, ORGANIZZARE PREVENTIVAMENTE I SEGNI, IN MODO DA REALIZZARE CORRETTAMENTE I SEGNI STESSI.



● PIENAMENTE D'ACCORDO
● CONCORDO
● INDECISO
● IN DISACCORDO
● FORTEMENTE IN DISACCORDO
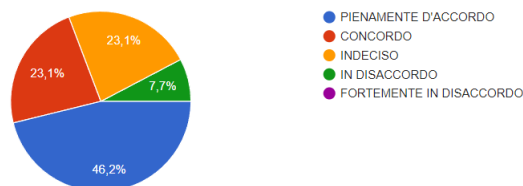
Graph. 9 (Motor control and marked languages)

*(fully agree , agree, indecisive, at odds, strongly disagreeing)*

In item number 9, the majority of the sample (69.2%) is in favor of the initial affirmation that it has as a theoretical reference the motor coordination control, understood as general coordinating ability (Melone I.M., 2023). 30.8% were unfavorable, undecided (23.1%) and at odds (7.7%). This factor implies in coherence with communicative action that even in marked languages it would seem appropriate to organize and control the signs as it happens with words in verbal communication. Apparently the item's answers are relevant to the starting assumptions. Finally, at question #10, 30.8% agree with the undecided (30.8%). 23.1% of respondents agree fully, followed by 15.4% disagree. Again no one strongly disagrees.

10. To learn a sign language it is essential to change , if necessary, the sign just started, to cope with unforeseen situations.

10. PER APPRENDERE UNA LINGUA SEGNATA E' FONDAMENTALE MODIFICARE SE NECESSARIO, IL SEGNO APPENA INIZIATO, PER FAR FRONTE A SITUAZIONI IMPREVISTE.



- PIENAMENTE D'ACCORDO
- CONCORDO
- INDECISO
- IN DISACCORDO
- FORTEMENTE IN DISACCORDO
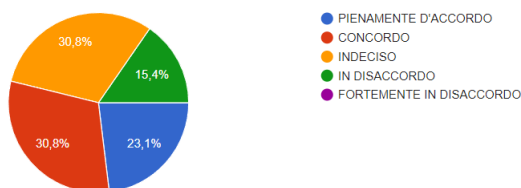
Graph. 10 (Motor adaptation and transformation and marked languages)

*(fully agree , agree,  indecisive, at odds, strongly disagreeing)*

In this item the sample is again divided into favorable (53.9%) and undecided/disagreed (46.1%). This data, which concerns the so-called coordinating capacity of adaptation and transformation (Melone I.M., 2023), brings us back in part to the considerations related to item number 8. About half of the sample agrees that, as in verbal communication, it is probably necessary to "modify" the words used, the tone and the volume according to the dynamics of communication. So in parallel this can also happen in marked languages. The other half of the sample instead (although the undecideds are the majority), probably believes that in the marked languages it is not possible or necessary to make corrections during the course of work. However, data/hypothesis adhesions are only partially overlapping.

**Conclusions**

Theoretically, the studies on the relationship between motor learning and languages marked in the field of non-verbal communication, would seem to merit further investigation but it is possible to say that the initial hypotheses have been filled. In fact, it seems indissoluble from the discussion of the data that the symbiosis body - non-verbal communication passes through motor learning and therefore there can be no learning of a marked language without first a motor learning. The limits of research exist and are basically to be found in the quantitative field; the number of the sample of the pilot project is limited and it is this factor that apparently hinders the process of knowledge on this field. Obviously the gap considered of numerical type can become an occasion for eventual future developments starting from the same methodological base. Expanding the sample numerically would lead to a more qualitative knowledge of the aspects considered so far. But also to administer the same questionnaire at intermediate levels of sign language trainees, would be a useful process to the analyzed research objectives. Still it would be possible with the same methodology to subject items also and

above all to a deaf community. So with the last observations we understand how starting from this contribution, it is plausible to realize and develop more the starting hypothesis, adding a further contribution to the link between neuroscience, motor learning and marked languages.

**References**

Aiello P. (2012), Corpo e movimento del corpo nella ricerca educativa: itinerari didattici per l'apprendimento linguistico, *http://hdl.handle.net/10556/664.*

Ambrosetti U. (2021), Linguaggio verbale e lingua dei segni, *https://hdl.handle.net/2434/869118.*

AA. VV.(2023), *Apprendimento motorio,*https://www.scienzemotorie.com/processi-e-fasi-dell-apprendimento-motorio/;

AA. VV.(2022), *Apprendimento motorio*, http://www.trainingpedia.it/approfondimenti/apprendimento-motorio-dai-processi-teorici-alla-pratica;

AA. VV.(2021), *Comunicazione non verbale*, https://sinapsicoaching.com/comunicazione/comunicazione-non-verbale;

AA. VV.(2017), *Comunicazione non verbale,*https://www.divulgazionedinamica.it/blog/elementi-della-comunicazione-non-verbale/;

AA. VV.(2023), *Lingua italiana dei segni – Lis*, https://www.ens.it/lingua-dei-segni

AA. VV.(2023),*Lingua italiana dei segni – Lis,*http://www.associazionecomunico.it/1/lis_lingua_dei_segni_italiana_2206600.html.

Biino V. (2021), *Manuale di scienze motorie e sportive. Giochi e lezioni per la scuola primaria*, Hoepli, Milano.

Bramlett T. (2020), *Linguaggio del corpo. I segreti della comunicazione non verbale per leggere la mente delle persone e interpretare le loro emozioni*, Independently Published, Bologna.

Colella D. (2015), Comunicazione e relazione nell'esperienza motoria, *https://hdl.handle.net/11369/333785.*

Zanetti E. (2022), *Una pedagogia per l'educazione Fisico – Sportiva*, Youcanprint, Lecce.

Fonti I. (2020), *Linguaggio del corpo. Come padroneggiare l'arte della comunicazione non verbale*, Jason Thawne, U.S.A.

Galfo L. (2022), *L'educazione motoria e la psicomotricità evolutiva*, Youcanprint, Lecce.

Ghiandelli G. (2019), *Comunicazione non verbale. Gesti e linguaggio del corpo*, OM, Bologna.

Giuliano B.,  Quartana G. (2018), La lingua dei segni come CAA e L2: da supporto a risorsa, *https://hdl.handle.net/10278/369724.*

Lucangeli D., Vullo L. (2021), *Il corpo è docente. Sguardo, ascolto, contatto: la comunicazione non verbale a scuola*, Erickson, Trento.

Martini N., Mastronardi V., (2020), Il mondo della comunicazione: comunicazione non verbale (CNV), programmazione neuro-linguistica (PNL) e strategie di persuasione, *Rivista di Psicopatologia Forense, Medicina Legale, Criminologia 2020; 25:547.*

Melone I.M. (2023), *L'attività fisica*, Europa Edizioni, Roma.

Mignosi E. (2020), Le forme della multimodalità. Segni, gesti e parole in classe, *https://hdl.handle.net/10447/423208.*

Moliterni  P.  (2014), *Didattica delle scienze motorie. Tra mediatori e integrazione*, Armando Editore, Roma.

Murolo  J., Marchi  M., Rossena  R. (2018), *Conosco il mondo con la LIS*, Erickson, Trento.

Pazienza V. (2020), *Manuale di comunicazione non verbale. Comunica Efficacemente con il Linguaggio del Corpo*, How2 Edizioni, Bologna.

Roccaforte M. (2018), *Le componenti orali della lingua dei segni italiana. Analisi linguistica, indagini sperimentali e implicazioni glottodidattiche*, Sapienza Università, Roma.

Sgambelluri R. (2017), Non verbal-communication in school age: didactic-inclusive aspects, *Formazione&InsegnamentoXV–2–2017.*

Stokoe W. (2021), *La struttura della lingua dei segni*, Cesati, Firenze.

Valenzano E., Sebastiani M.M. (2018), *Apprendere la LIS con il percorso Lunetta*, Aracne, Roma.

Volterra V., Di Rienzo A., Roccaforte M., Fontana S. (2019), *Descrivere la lingua dei segni italiana. Una prospettiva cognitiva e socio semiotica*, Il Mulino, Bologna.