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# ALESSANDRO PUGLISI

# Learning Data Analysis and Action Research: Opportunities for the Online Language Teacher's Self-training

# Abstract

In the linguistic education field, the growing interest in online language teaching and learning leads to new opportunities for teacher training, within the *infosfera* (Floridi 2014). This intervention focuses on a "self-training" model. This proposal, situated within a connectivist perspective, applies data science to online didactic interactions (Puglisi 2021) and considers action research (Carr and Kemmis 1986) as a tool for investigating remote educational contexts. Therefore, the intention is to contribute to the investigations of the relationship between linguistic education and technologies, suggesting possible applications of innovative models for the continuous teachers' self-training.

# Keywords

Self-training, e-learning, data science, action research, didactic interactions

# 1. Introduction

The domain of online language learning, inherently dynamic, has witnessed significant transformations in recent years, a trend attributed in part to the burgeoning interest in non-formal online learning modalities. This shift has been precipitated by the social constraints imposed during the Covid-19 pandemic. Reports indicate a marked growth in this sector, propelled by the advent of MOOCs and augmented by substantial investments from providers (Shah 2020). However, this trend may not represent a sustainable economic strategy in the medium-term perspective (Shah 2022). Notwithstanding, the reconfiguration of the online learning ecosystem is undeniable, ushering in an array of conceptual, theoretical, and practical challenges. The expansion of non-formal and informal online learning contexts has catalysed a diversification of learning environments. Consequently, there has been a notable escalation in the volume of learning data generated. This data emanates from user interactions with digital content, educational platforms, peer learners, and pedagogical facilitators, including teachers and tutors. These interactions contribute to the creation of a considerable amount of data within an intricate informational system (Fallani 2020) or, in other terms, infosfera (Floridi 2014). Considering these

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evolving dynamics, a critical examination of how learning data can be optimally leveraged within data analysis methodologies is imperative. Such an inquiry is essential to formulate effective protocols for the autonomous professional development of language teachers and tutors in online environments.

The proposal at the heart of this intervention aims to harness the synergy between the analysis of online learners' didactic interactions and action research. The objective is to provide a potential data-driven self-training model for online language teachers and tutors. It follows that the proposed protocol will require practical experimentation, conducted by educators and online tutors to assess its effectiveness and applicability in real-world contexts. This perspective highlights the increasingly urgent need to reconcile two poles: on one side, the now outdated centrality of the teacher, the focus of past approaches and methods, and on the other, the communicative turn that has placed the learner at the centre. From our standpoint, it is not feasible to rigorously address the training of teachers and tutors without starting from their own didactic action and the effects it produces, which can be analysed in objective and subjective, quantitative, and qualitative terms. For all these reasons, a protocol for the self-training of online modern language teachers and tutors is proposed, integrating the quantitative and objective component (learning data) with the qualitative and subjective one (action research conducted by the teacher/tutor).

This contribution is structured as follows: the second and third sections are dedicated to defining the main characteristics of online didactic interactions and those of action research in education, respectively. The fourth section delves into learning social network analysis, while the fifth section offers a detailed description of the proposal. Finally, the sixth (and last) section presents some concise conclusions.

## 2. Learning interactions on the Web

In any educational setting, be it a conventional classroom or an online learning platform, led by an instructor or self-paced, and relevant to any area of knowledge, the fundamental element is the learning interaction. This refers to all events that occur during the educational process. Thus, education is more an interaction than an action, involving, at its most basic, a teaching subject, a learning subject, and content to be learned. Even in cases where the role of the teaching subject blends into that of a tutor/facilitator (Tomkin and Charlevoix 2014), and even where the learner autonomously explores the offered content, there is what has been termed 'internal didactic conversation' (Holmberg 1981). Moreover, it is posited that such an 'internal didactic conversation' is present in all educational endeavours, leading to the conclusion that each participant in a learning environment, be they educators or students, engages in self-dialogue and interacts with others, including peers and instructors, within contexts of varying significance, as suggested by the reflections of symbolic interactionism (Blumer 1969). Furthermore, the online learner typically aspires to a high degree of autonomy, positioning themselves in the 'theatre of power' (Mazzone 2022), that takes place within an online course, as a *self-directed learner* (Knowles 1975).

To delve deeper into the characteristics of online didactic interactions, a fruitful perspective is that of transactional distance theory. This model, proposed in the early 1970s (Moore 1972, 1973), addresses learning in a broad sense and identifies three macro-factors: structure, dialogue, and autonomy, each variably represented within a distance education context. The *structure* of a course is shaped by its content, the amount of learning material, and its arrangement in a fixed, logical sequence, marked by precise timing. In courses with less rigidity in structure, learners gain greater autonomy to pursue learning at their own pace and explore their individual interests, potentially leading to non-linear educational trajectories. The *dialogue* factor represents "a particular kind of interpersonal interaction" (Moore 2012: 70), as "teachers exchange words and other symbols with learners, aimed at the latter's creation of knowledge" (Moore 2012: 70). Understandably, it can be visualized as a continuum: "courses of instruction may allow almost continuous dialogue between students and teachers or none, and there is a range of variation between the extremes" (Moore 2012: 70). Transactional distance is a function of each of the two factors and has a direct proportional relationship with structure and an inverse one with dialogue. In other words, if a course's structure increases or dialogue decreases, transactional distance grows. To these two factors, a third macro-factor is added, learner autonomy, which is the learner's greater or lesser possibility or capability to develop a personal learning plan. Learner's autonomy is directly reflected through 1) objectives, that is, what to learn; 2) execution, or how to learn; and 3) the extent of learning. It also relates to transactional distance, in that a more autonomous learner can implement strategies to increase transactional distance, through an increase in structure and a decrease in dialogue, regardless of the teacher's actions. Similarly, an online teacher/tutor can, within certain limits and varying from course to course, implement strategies to regulate transactional distance. Therefore, the distance discussed here is not physical or geographical, but a 'pedagogical' distance that emerges in the 'transaction' between the involved agents, namely the teacher/tutor, learner, content, and platform; the simultaneous presence of human and non-human agents here very clearly recalls the Actor-Network Theory (ANT) (Latour 2005). Viewing learners through a 'Blumerian' lens, as individuals shaped by external forces and internal reflections, aligns with transactional distance theory, thereby providing a robust theoretical base for our proposed protocol.

#### 3. Action-Research in Education

Numerous definitions of Action Research (AR) highlight its diverse aspects and specific meanings. One of the main definitions is "a term that is used to describe a global family of approaches that integrate theory and action with the goal of addressing important organizational, community, and social issues together with those who experience them" (Coghlan and Brydon-Miller 2014: XXV), empha-

sizing its roots in social sciences and direct engagement with real-world challenges. Carr and Kemmis provide a more introspective definition: "Action Research is implying a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out" (1986: 162).

In AR, a range of tools and methods are employed to facilitate this cyclical process of reflection and improvement. These tools include diaries and reflective journals, in which experiences and insights can be documented. Interviews and focus groups are used to gather in-depth qualitative data from participants and stakeholders. Surveys and questionnaires provide quantitative data that can inform and guide the research process. Observation, both participant and non-participant, is crucial for gaining a direct understanding of the context and practices being studied. Additionally, document analysis of existing materials and resources offers a background and baseline for the research. These tools, used in concert, enable a comprehensive and multi-faceted approach to understanding and improving practices in educational and other social settings.

In this exploration, we adopt a broad interpretation of AR, viewing it as a collection of tools and techniques, including self-reflection, that empower teachers to refine their practices and actions in a cyclical, improvement-oriented manner. It is crucial to note that action research is not episodic, nor does it coincide with the daily teaching practices of individual educators; rather, it entails five spiralling phases, at least on a rough level, as advocated by Kemmis *et al.* (2014): 1) planning; 2) acting; 3) observing; 4) reflecting; 5) evaluating.

AR must be also characterized by four distinct attributes: 1) self-initiated; 2) situational; 3) systematic; and 4) qualitative. The first attribute is about self-motivation and genuine engagement in the research process. Moreover, AR must be situational, meaning context-specific, because it addresses issues and challenges in a particular environment or setting, and systematic, following a methodical approach in planning, data collection, analysis, and reflection. The last attribute implies the usage of qualitative methods to gather data; this will be crucial for our proposal, in which the "quantitative side" will be covered by social network analysis.

#### 4. Learning social network analysis

In the sociological research scenario, the interplay between social capital and social network analysis has garnered significant attention. Thus, in this section we try to delve into how social network analysis serves as a pivotal tool for unravelling the complexities of social capital. It is, therefore, appropriate to start with the concept of *social capital* as it has been constructed in the scholarly literature.

Durkheim, in a seminal study, postulated that societal integration transcends mere individualistic pursuits, necessitating an underpinning of contractually established relationships, anchored in moral norms (Durkheim 1997 [1893]). Consequently, this societal fabric is paradoxically unified by the diversification of its members, necessitating engagement in robust, cohesive social collectives. Extending this discourse, Weber and Simmel elucidated further these concepts, pivotal to the understanding of social capital. Weber delineated social capital into three distinct categories: 1) as a private asset yielding individualistic benefits; 2) as an exclusive club good; 3) as a collective good with broader communal impacts. Specifically, his focus was on societal constructs, like Protestant sects, where membership conferred reputational benefits. Similarly, Simmel's examination centred on 'social circles' (Chiesi 2000), foundational to contemporary social network analyses. In contrast, Bourdieu critiqued social capital as a mechanism perpetuating social stratification and inequality. He posited economic capital as superior to other forms, characterizing social capital as the aggregation of relationship-derived resources (Bourdieu 1980). Building on these notions, Coleman contributed pragmatic insights into social capital, emphasizing the role of obligations, expectations, and reciprocity within interpersonal dynamics (Coleman 1990). He theorized that active participants in a social network accumulate beneficial connections, subject to variations in trust and external institutional support. Pizzorno's discourse on social capital, instead, underscored the significance of enduring, solidarity-driven, and reciprocal relationships. He distinctly categorized social capital into two forms: solidarity-based and reciprocity-based, the former emerging from tightly-knit group interactions (Pizzorno 1999).

Social Network Analysis (SNA) fits within the broader framework defined by the term Learning Analytics (LA), that was broadly defined in the 2011 call for papers for the first international conference on Learning Analytics and Knowledge as the measurement, collection, analysis, and presentation of data about students and their contexts, for the purpose of understanding and optimizing learning and the environments in which it takes place.

This definition can be applied to a wide variety of different situations. To narrow the scope, it is understood that Learning Analytics uses pre-existing, machine-readable data. The connection between LA and social networks, leading to SNA, lies in the advancement of social learning, rooted in computer-supported collaborative learning (CSCL) and extends to non-academic contexts, the use of free online learning tools, and a trend towards unstructured, informal and/or non-formal online learning.

In the light of this, our proposal encompasses SNA as the main methodology. Discussing SNA means analysing social networks, defined as «networks in which the vertices are people, or sometimes groups of people, and the edges represent some form of social interaction between them» (Newman 2010: 36). In our specific case, it must be considered that networks are not only made up of people, but also involves non-human agents, such as educational contents (texts, videos, quizzes), web-pages and interfaces.

Therefore, we can use SNA to determine the greater or lesser ability of learners to mobilize social capital within a social learning network. This is feasible by rep-

resenting the social network through a graph, that is a mathematical structure encompassing nodes (entities) connected by edges (relations), and calculating centrality measures (Puglisi 2021) relative to the learners, such as betweenness centrality, closeness centrality and cross-clique connectivity. Betweenness centrality quantifies the importance of a node in a network by measuring the frequency at which it appears on the shortest paths between other nodes, thus acting as a critical conduit or bridge within the network structure. Closeness centrality reflects the degree to which a node is near all other nodes in the network, highlighting its accessibility or reachability. Cross-clique connectivity focuses on a node's ability to connect different cliques within a network, thereby serving as a crucial link that integrates otherwise isolated segments.

Combining AR and SNA for analysing online language learning contexts is foundational to our proposal for a self-training protocol for online language teachers.

## 5. Online language teacher's self-training: a proposal

Our proposal applies better, but not exclusively, to online language courses with large numbers of learners, delivered either via LMS or CMS and it is obviously applicable in contexts where a teacher/tutor is present. In the absence of such contexts, the action research component is not feasible, as the protocol relies on the active involvement and reflection of educators or facilitators. The proposal tries, as already noted, to combine social network analysis and action research. Thus, it involves the intertwining of these two levels of analysis to enhance learning paths and verify the effectiveness of these improvements, potentially merging the boundaries between AR and applied research. However, it is crucial to clarify that action research retains its essential characteristics as a practice performed by teachers on their own work, aimed at their personal and professional development, and a deeper understanding of the "world" under examination. Notably, action research does not aim to generalize the findings; this task is more appropriately assigned to social network analysis.

Our central approach involves representing teaching interactions using graphs to apply social network analysis tools. It is important to note that interactions within an online language course occur among learners and between them and the tutor(s), as well as with the content and user interface, which shapes content and influences its dynamics of use. Therefore, a dataset representative of what has occurred within a specific course can be created. Social network analysis should be performed after the course to prevent unsupported hypotheses or conclusions. This analysis provides insights regarding the quantity of interactions, the active learners, those who have gained central positions in the network, the interaction dynamics between tutors and learners, and learners' access to course resources. These data, properly represented and interpreted, offer a solid foundation for the teacher's self-reflection process. Unlike social network analysis, AR must occur concurrently with the course and be completed before starting the social network analysis. It must be initiated by the teacher/tutor within the online course and be situational, systematic, and qualitative. In adopting our proposed methodology, there is no room for preconceived thoughts, so the entire process must follow a precise plan, prepared, and rigorously adhered to, even in documentation production.

At this point, the best tools for AR need to be identified. In this case, we suggest using at least one introspective subjective tool, like a diary kept by the teacher/ tutor, and a couple of descriptive tools, such as the anecdotal record. The diary will focus on the teacher/tutor's self-reflection during the course (Nunan 1989), while the other tool will help identify individual student behaviours in certain situations and the characteristics of standout participants. These observations should come, in an online context, from course forums or, if available, from activities involving the production of 'artifacts' such as texts, presentations, videos, and mind maps.

The 'triangulation' process can be completed by combining the products of the action research (teacher/tutor's diary, anecdotal records) with the results of the social network analysis from the linguistic MOOC.

Therefore, the procedure includes two sets of operations:

- 1. AR initiated and conducted by the teacher/tutor during the course.
- 2. *Ex-post* analysis of the social network generated within the online course through didactic interactions.

More specifically, we identify four phases in which individual steps from the two sets of operations intertwine:

- 1. Initial: the monitoring system for didactic interactions is set up (if not already available on the platform), and the teacher/tutor prepares the tools that will be used (diary, anecdotal records).
- 2. Central: during the course, the monitoring system automatically collects data on interactions, while the teacher/tutor maintains a diary and compiles anecdotal records.
- 3. Final:
  - a. Subjective: the teacher/tutor reflects on their actions through the products of AR;
  - b. Objective: the analysis of the social network formed within the online course is conducted using appropriate tools, for example the statistical analysis software *R*.

Beyond and after these phases, there is a critical moment that can take various forms and be conducted on different timelines, depending on the different stakeholders involved in applying the methodology. This moment relates to finding common points between data analysis and action research and the possible subsequent implementation of changes to content and tutoring behaviours.

# 6. Conclusions

This contribution offered some considerations on the changing dynamics of online language learning, highlighting some of the challenges and opportunities that arose in the post-Covid 19 pandemic era. These are mainly related to the growing amount of learning data produced in formal, informal, and non-formal online learning contexts. Consequently, new forms of language teachers' self-training can be implemented, trying to reconcile teaching actions with learners' centrality. Otherwise, there is a tangible risk of designing learning environments and courses while overlooking either aspects related to the actions of educators or the needs of learners. The described proposal, designed for online instructor-led language learning contexts, makes use of AR procedures and tools to allow the teacher/tutor conducting a self-reflection. At the same time, it aims to represent and study the interactions within an online course by means of graphs. This last objective is pursued through social network analysis (SNA) and, more specifically, calculating centrality measures (betweenness centrality, closeness centrality, cross-clique connectivity). The integration of AR and SNA allows for an accurate "description" of online courses from both a quantitative and qualitative point of view, giving teachers an opportunity for self-training. Due to the nature of this contribution, the validity of the proposed model requires confirmation through its application in real-world learning contexts, as outlined in the introductory section; nevertheless, we believe it can effectively contribute to a more balanced integration of the perspectives of teachers and learners on the Web.

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