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Abstract

Teacher education aims to move students from novice to expert level. In this study, we analysed student's textual peer feedback on video recordings of their teaching practice. First, the impact of the curriculum and literature on students' feedback by the network analysis of prominent words. Secondly, the lexical richness and the semantic cohesion of students' feedback and reflections. Our findings show that students created stronger connections between the prominent words from the literature. The lexical richness and semantic cohesion also increased. This means that students incorporated vocabulary from expert sources and maintained semantic consistency while using the expert vocabulary.

Keywords: network semantic analysis, discourse analysis, lexical richness, semantic cohesion, students' feedback

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The present study is framed in the context of the Erasmus+ knowledge Alliance Video-Supported Collaborative Learning (ViSuAL) project. The main objective of this project (author, 2017) is to research pedagogy for using video in supporting collaborative learning. In the present article, we report an experiment in bachelor-level courses of a Vocational Education and Training (VET) teacher education curriculum in the Netherlands. This experiment aimed to support student teachers' development from 'novice' to 'starting expert' by using teacher-students' video recordings of their teaching practice and peer feedback.

The use of video has shown its potential to impact teaching practice, both in teachers' pre-service education and in-service professional development. However, the combination of video use with more current pedagogical approaches like knowledge building or active, collaborative learning is rarely seen in the classroom.

According to Radović et al. (2020), more authenticity facilitates experiential learning while strengthening the ties between theory and practical learning experience. The use of video has shifted over the last years from video presentation and analysis towards video annotating tools to support students' reflections in teacher education.

Method

The study concerns a pre-experimental one-group case study design (Campbell & Stanley, 1966; Shadish, Cook, & Campbell, 2002) where repeated observations are made. It follows the structure of x-O-x-O-x-O-x-O-O^f, where x stands for a video recording of authentic teaching practice of a student teacher, O for peer feedback from several peers, and O^f for students' final reflection assignment. Dependent variables to indicate the growth of expertise were lexical richness, semantic cohesion and betweenness centrality. Data we analyzed concerned the student's peer feedback to classroom teaching practice video recordings of their peers.

Participants

The student teachers worked together in small sub-groups. The class group consisted of 15 part-time student teachers (ten males and five females) in a Bachelor's teacher education program in the Netherlands. The student teachers were already teaching in different domains at vocational secondary education schools (VET). The average age of the students was 42.4 years (sd 8.7).

Variables

Lexical richness has been previously used as one of the linguistic variables to assess Alzheimer's disease progression, where patients tend to have a low lexical richness rate (Hernández-Dominguez, Ratté, Sierra-Martínez, & Roche-Bergua, 2018). In contrast to the loss of words and meaning as in Alzheimer's patients, our hypothesis is that students will acquire more vocabulary items and professional terms during the learning process, and that their lexical

richness will be increased at the end of the course. Also, formal academic writings present high values of lexical richness (Biber & Conrad, 2019; Staples, Egbert, Biber, & Gray, 2016). For this study, we used the Type-Token Ratio (TTR) in a Natural Language Processing (NLP) approach to measure the lexical richness of students' vocabulary. In our case, we evaluated the students' vocabulary each month to detect when it increased.

While the lexical richness reflects the variety of the lexical items, it does not reflect the meaning that they create together. Thus, we included the assessment of *semantic cohesion* of the students' comments as a complement to the lexical analysis. We used two metrics that reflected the semantic cohesion. The first one was based on the semantic similarity between all words in a given text. The second one was based on the centroid distance between all words given in a segment of text (Korenčić, Ristov, & Jan, 2018).

Next, we used an analytic tool to explore network structures of collaborative learning discourses Knowledge Building Discourse Explorer (KBDeX)¹. We used KBDeX to calculate the *betweenness centrality* to measure the extent to which a word influenced other words in the conceptual network of words. The reason is that we wanted to know the mediating function of the words in the students' conceptions that are representative of topics emerging in the literature. At the word level, a betweenness centrality value of 1 means that a word is highly influential, whereas a value of 0 means that a word is equally influential as other words. The betweenness centrality measures the number of node pairs and the shortest path between them that pass through a node. It suggests that the selected node works as a key mediator in linking other nodes (Matsuzawa et al. 2012; Oshima et al. 2013).

¹ <http://www.kbdex.net>

Procedure

As part of their four-year curriculum, the students took part in a course about pedagogy. The course content comprised the six main roles of a teacher (Slooter, 2018) and collaborative learning. During the course, which lasted four months, the students had to follow lectures and read literature, and also video-recorded their own teaching practice in VET schools. They uploaded their recordings into the Iris Connect environment² in which they could give monthly peer feedback on the video recordings of peers. To give their commentary on each other's recorded videos, students were divided into four small groups. In the last month, the student teachers used the peer feedback and course literature to write reflections on their teaching practice as a final assignment.

The data we collected consisted of students' comments (peer feedback) on video recordings during their teaching at VET schools in the Netherlands and their final reflections.

Analysis

We identified topics by applying topic modelling methods, a probabilistic technique used in machine learning (ML) and (NLP) to explore a collection of documents. A topic represents a group of words with a high likelihood of occurring together in a document (Ignatow & Mihalcea, 2017). The rationale behind this method is that meanings are relational (Geeraerts, 2010; Saeed, 2011). The resulting group of words may also be interpreted as lexical fields. The meaning of the words in a lexical field depends on each other; together, they form a conceptual structure that is

² www.irisconnect.com

part of a particular activity or specialist field, such as a lexical field associated with school (e.g., teacher, book, notebook, pencil, student, etc.).

We used a well-known statistical language model, Latent Dirichlet Allocation (LDA), to generate the topics (Ignatow & Mihalcea, 2017). The data used for this analysis corresponded to the literature used by students during their course. We used the LDAvis (Sievert & Shirley, 2014) library in Python, which allowed us to compute topic models and visualize topics in a Cartesian-like space. This library uses LDA as a technique to identify topics (Blei, Ng, & Jordan, 2003). For the topic modelling analysis, we did not consider the time as a variable to analyze the topics' evolution during the semester.

We pre-processed the data by conducting the usual tokenisation, lemmatisation, and part-of-speech (POS) tagging. Tokenising involves separating a text into sentences and sentences into words. Lemmatisation reduces a word to its canonical form; for example, nouns are put into their singular form (children-child), and verbs into the infinitive form (was-be). POS tagging identifies the lexical part of speech, whether a word is a noun, a verb, an adverb, and so on. This process allowed us to filter tokens by their POS tags and used only nouns and adjectives, which are some of the linguistic features common in informational writings (Biber & Conrad, 2019). The reason for filtering only using nouns and adjectives is that we wanted to analyse the attitude towards learning and teaching of the student teachers. Moreover, the frequency of nouns and adjectives has been used to analyse the differences between scientific writings and technical reports.

According to Biber and Conrad (2019), academic prose has a higher frequency of nouns than conversations.

Results

Overall, our results show that the lexical richness in the students' peer feedback and reflections increased, indicating that these students were developing from novices into experts. It can be concluded that the students' use of 'expert vocabulary' grew during the course, as evidenced by the lexical richness (see fig. 1) and the semantic cohesion based on centroid distance (see fig. 2) . In other words, students incorporated new vocabulary and maintained semantic consistency.

Figure 1

Results for lexical richness using the TTR score.

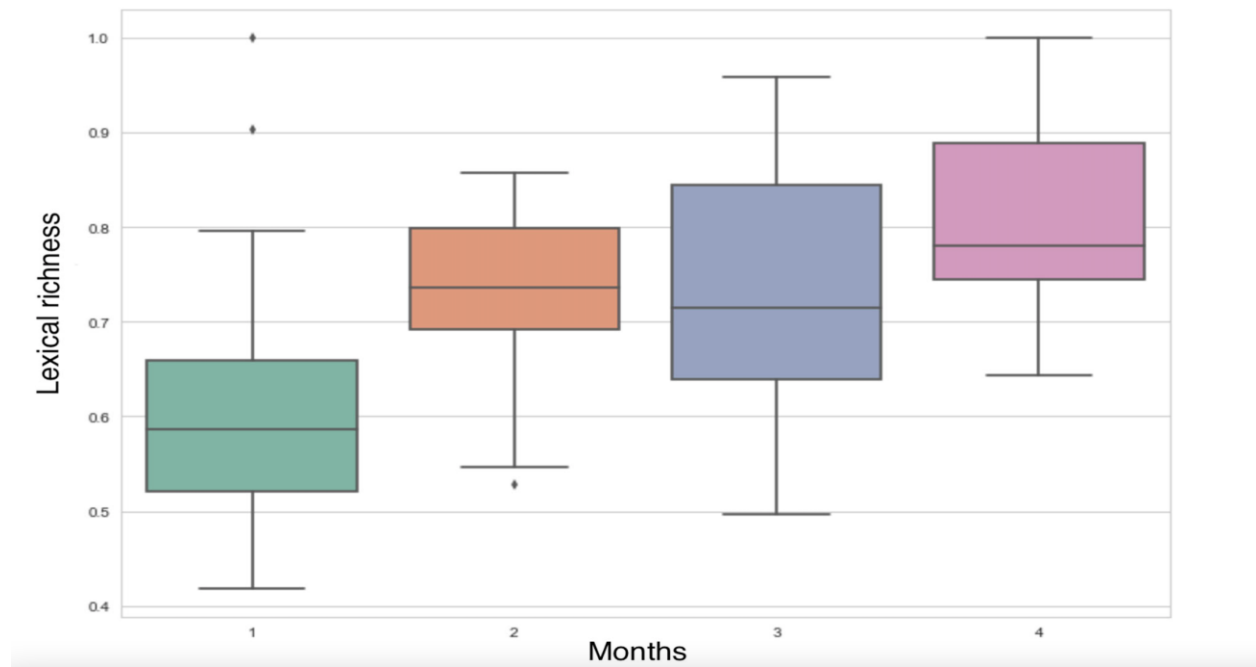
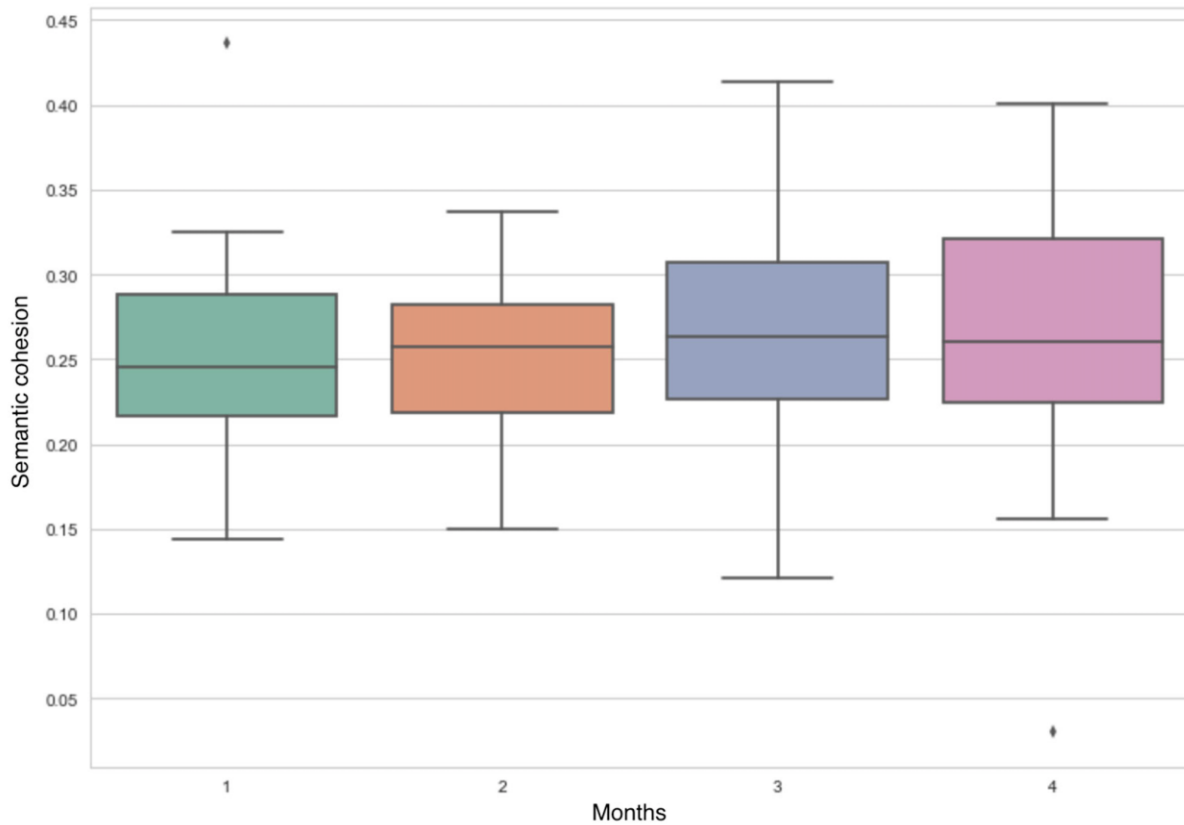


Figure 2

Results for similarity-based semantic cohesion.



Results show that in the beginning of the course, student teachers had little knowledge of the literature concerning interaction and teaching practice. Giving more useful, content-related peer feedback on peers' teaching practice requires more knowledge and understanding that leads to a cohesive teaching concept. This developed during the course, as could be seen by two factors. First, lexical richness increased steadily over time for all four subgroups. Second, KBDeX analysis of the word networks show that at the end of the course the networks were stronger than in the word networks at the start (see fig. 3). At the end of the course, stronger relations were established between a larger number of topic keywords. Thus, expanding students' activities with

Although the findings are interesting, this study has limitations. First, the number of respondents was limited, and there was no intervention or control group. Secondly, there was only one teacher trainer involved and the influence of teaching style, experience and other personal characteristics was not investigated. Furthermore, the influence of collaborative learning by peer feedback was not investigated at an intensive level of collaborative learning as was intended.

Although we analysed data from several points in time, as in an equivalent time sample design, no effect of testing, selection, or other internal validity errors is to be expected. This is because the students did not know about the analysis, and the data consisted of their periodic feedback instead of repeated survey answers. The Covid-19 pandemic had an impact on the teaching practice during the experimental period and on some student-groups were unable to give peer feedback at the agreed-on times. Nonetheless, lexical growth and use of 'expert' concept words was still observed.

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