Amenduni, F., & Cattaneo, A. (2021). Digitally enhanced apprentices' perception of connectivity across learning locations. In C. Nägele, B.E. Stalder, & M. Weich (Eds.), *Pathways in Vocational Education and Training and Lifelong Learning. Proceedings of the 4th Crossing Boundaries Conference in Vocational Education and Training, Muttenz and Bern online, 8. – 9. April* (pp. 39–44). European Research Network on Vocational Education and Training, VETNET, University of Applied Sciences and Arts Northwestern Switzerland and Bern University of Teacher Education. https://doi.org/10.5281/zenodo.4604884

Digitally Enhanced Apprentices' Perception of Connectivity Across Learning Locations

Amenduni, Francesca
francesca.amenduni@iuffp.swiss, SFIVET - Swiss Federal Institute for Vocational Education and Training, Lugano, Switzerland

Cattaneo, Alberto
alberto.cattaneo@iuffp.swiss, SFIVET - Swiss Federal Institute for Vocational Education and Training, Lugano, Switzerland

Abstract

When crossing the borders from educational to professional environments, VET apprentices can perceive discontinuities and contradictions between what they learn at school and in the workplace. This research explores whether a digital tool named e-DAP, designed as a space for reflective practices in VET educational systems supports apprentices' perception of connectivity across learning locations. A group of 114 apprentices who used the e-DAP and a control group (CG) composed of 141 apprentices (CG = 141) completed a 15-items questionnaire which investigated the following dimension: 1. frequency of use of the e-DAP platform 2. mutual knowledge across locations, 3. explicit connectivity and 4. perceived usefulness of the tool. Participants were asked to express their level of agreement on a 6-point Likert scale on the items in sections 2 and 4 and on a 5-point Likert scale on the items in section 3. On average, the e-DAP users perceived the usefulness of the platform to be high (M = 4,55; SD = 1.12). The perception of connectivity resulted, in general, higher in the e-DAP group than in the CG. Specifically, mutual knowledge and explicit connectivity were perceived significantly higher. Frequent users (FU) of the e-DAP had a higher perception of explicit connectivity than low users (LU). This difference was even higher when comparing FU and LU according to their use of the e-DAP at the workplace. Results are in line with the expected learning path of the e-DAP, inspired by the Erfahrraum model. The more apprentices collect traces of workplace experiences through the e-DAP, the more VET teachers can support explicit reflection on practice at school. In future exploration, we are going to test the effect of the perceived usefulness of the e-DAP on apprentices' perception of mutual knowledge and explicit connectivity.

Keywords

connectivity, digital boundary-object, VET apprentices

1 Introduction

Boundary-crossing literature has provided new lenses to study learning in European vocational education and training (VET) dual systems, with implications for the design of pedagogical tools and methods. Boundary crossing requires students to face the uneasy challenge of nego-

tiating and combining different experiences and hybrid situations to achieve novel goals (Akkerman, & Bakker, 2011). Indeed, when crossing the borders between educational and professional environments, VET apprentices can perceive discontinuities and, consequently, struggle to connect what they learn at school and in the workplace (Berglund & Henning Loeb, 2013; Kilbrink & Bjurulf, 2013).

However, if accompanied by reflection, perceived contradictions between the different VET *activity systems* (such as school and workplace) are worth facing as they can be vital forces for change, learning and development (Engeström, 2015; Illeris, 2011). Several research studies investigated how to create spaces for reflective practices in VET educational systems through the support of digital technologies. On these bases, for example, the *Erfahrraum* model has been developed (Schwendimann et al., 2015). The *Erfahrraum* is a technology-enhanced pedagogical model for supporting students' learning at the borders across vocational learning locations. According to it, when adequately exploited, technologies can provide a specific space to reflect upon apprentices' professional experiences. Technologies acquire the role of *boundary objects* with a bridging function between educational and professional contexts (Star, 1989) allowing actors of different locations to meet and negotiate meanings.

Previous research on the use of technologies as boundary objects focused on students' learning outcomes, such as metacognitive learning strategies (Schwendimann et al., 2018) and the acquisition of professional declarative knowledge (Cattaneo et al., 2015). However, the impact of digital boundary-objects on students' perception *connectivity* is still poorly explored (Caruso et al., 2020). Connectivity can be defined as "the purpose of that pedagogical approach which educators would adopt in order to take explicit account of the relationship between theoretical and everyday knowledge in their attempt to mediate the different demands arising in the contexts of education and work" (Griffiths & Guile, 2003, p. 59). Based on this definition, we operationalized apprentices' *perception of connectivity* as the belief that their VET educators

1. share a mutual knowledge about their respective roles in assisting learners to develop as professionals across boundaries,
2. make the connectivity explicit through the reference to the learners' authentic situations at school and at the workplace.

This research is aimed at exploring the impact of a digital boundary-crossing environment on Swiss apprentices' perceived connectivity across learning places.

2 Context of the research and methods

The Swiss VET is predominantly based on a dual system: practical training (apprenticeship) on three to four days a week in a training company is supplemented by theoretical classes on one to two days a week at the VET school. Besides, the VET students attend branch courses, in which they enhance vocational practical skills (Strahm et al., 2016).

The Swiss project Dual-T was aimed at supporting the connectivity across the three VET learning locations by developing digital learning tools specifically designed to work as boundary-objects, in compliance with the *Erfahrraum* model.

In this paper, we explore the perception of connectivity of apprentices who have used a specific digital tool, named e-DAP. The e-DAP was designed to allow apprentice chefs to create a recipe book exploiting the pictures they take on the job with their mobile devices (Cattaneo et al., 2015; Cattaneo et al., in press). The recipe book is part of the apprentices' Learning Professional Documentation, a required activity in the Swiss VET system in which learners document their professional experience and in-company trainers check its accuracy.

In the e-DAP, apprentices' reflection is supported through a series of embedded prompts and feedback from their supervisors (Mauroux et al., 2016). VET teachers can use apprentices' pictures to bring meaningful professional situations into the classroom (Hämäläinen & Cattaneo, 2015). In this way, the visual traces circulate from apprentices' workplaces to the school and vice-versa.

To explore the e-DAP users' perceived connectivity across learning locations, a short questionnaire has been developed based on a previous survey (Caruso et al., 2020). The questionnaire is structured in five sections:

1. Three questions (one per location) on the *frequency* of use of the e-DAP platform across the 3 locations on a scale from 1 (never) to 5 (every time I am there).
2. A scale on the perceived *mutual knowledge across locations* about VET educators' respective roles in apprentices professional learning (5 items, e.g., "My professional knowledge teacher knows what we do in our practical training").
3. A scale on the *making connectivity explicit* among locations (4 items, e.g., "My professional knowledge teacher asks me to bring concrete examples of workplace situations to discuss them in class").
4. A scale on the *perceived usefulness* of the platform (3 items, e.g., "e-DAP helps me to connect what I do at school with what I live at the workplace").

Participants were asked to express their level of agreement on a 6-point Likert scale (from 1 = completely disagree to 6 = completely agree) on the items in sections 2 and 4 and on a 5-point Likert scale on the items in section 3. The questionnaire has been submitted in June 2020 to all the e-DAP users who have been active in 2019-2020 (EXP) and to a random selection of classes who never used any Dual-T platform that we treat as a control group (CG). We collected 114 questionnaires from e-DAP users and 141 questionnaires from the CG. We will report descriptive results on the frequency of use and perceived usefulness of e-DAP. We will show a comparison between the e-DAP users and the CG along the following dimensions: a) *perceived mutual understanding* b) *making connectivity explicit.* We will also show a comparison between the e-DAP frequent users (FU), who used the e-DAP from most of the times (4) to every time (5), and low users (LU), who used the e-DAP from never (1) to seldom (2). For each scale, we will report its internal reliability (α).

3 Results

In Figure 1, we reported frequencies of e-DAP use in the three main different learning locations of the Swiss VET system. Most of the apprentices used frequently the e-DAP in the school context and half of the apprentices used frequently the tool in the context of intercompany courses. On the other hand, the majority of the participants used the e-DAP in the workplace from seldom to sometimes.

Perceived usefulness (α = .871) scores can be considered positive because the average score is 1 point higher than the median score of the scale of 3.5 (see table 1 for details).

Given that a normal distribution was not met, we used a Mann-Whitney Test to check for any significant differences between the control (CG) and the experimental (EXP) groups in terms of *mutual knowledge* and *explicit connectivity*. The analysis showed a significant difference between groups concerning *mutual knowledge* $U(N_{CG} = 140, N_{EXP} = 112) = 6542.000$, z = -2.263598, $p = .024$, r = 0.13 and *explicit connectivity* $U(N_{CG} = 141, N_{EXP} = 114) = 6446.500000$, z = -2.730 $p = .006$, r = 0.17 indicating that perceived *mutual knowledge* and *explicit connectivity* is higher in the e-DAP group than in the CG. Descriptive statistics are reported in Table 2.

Figure 1
Frequency of use of e-DAP, across learning locations

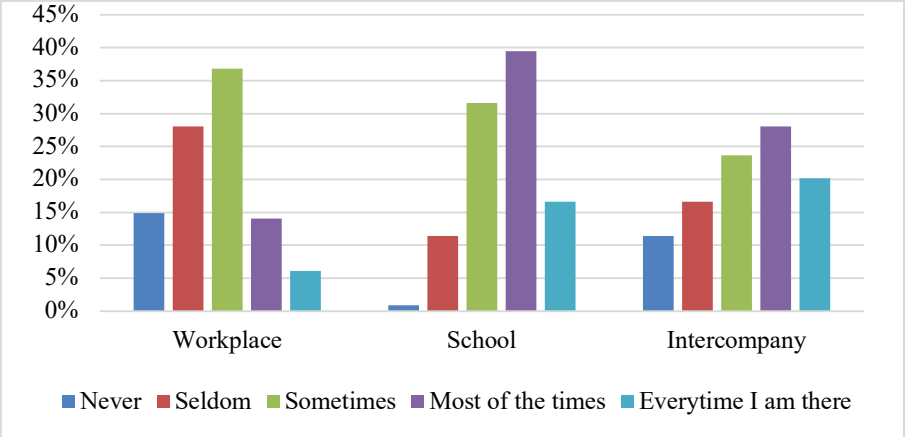


Table 1
Perceived usefulness of the eDAP platform

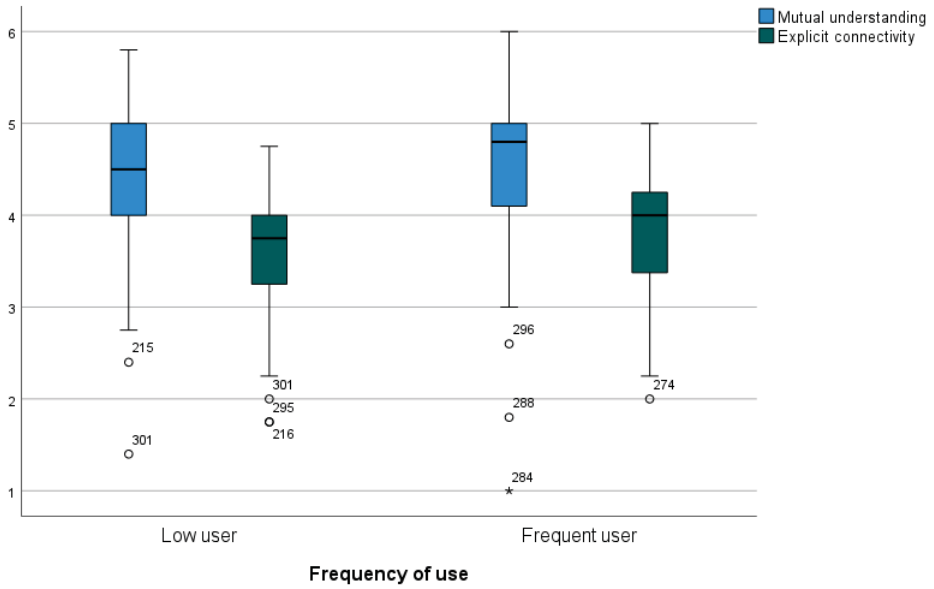
	N	Mean	*SD*
Using e-DAP helps me to connect what I do at school with what I live at the workplace	113	4.52	1.32
I like using e-DAP	113	4.23	1.34
I find e-DAP useful	113	4.91	1.24
Mean usefulness	*113*	*4.55*	*1.12*

Table 2
Descriptive statistics of mutual knowledge and explicit connectivity per condition

	Group	*N*	Mean	*SD*
Mutual knowledge (α = .806)	Control	140	4.18	1.05
	eDAP	112	4.49	.94
Explicit connectivity (α = .648)	Control	141	3.41	.74
	eDAP	114	3.66	.78

We have also investigated the difference between Low users (LU) and Frequent users (FU) in terms of *mutual understanding* and *explicit connectivity*. The analysis showed a significant difference between groups only for *explicit connectivity* U(N_{LU} = 59, N_{FU} = 55) = 1255,5 z = -2.095, p = .036, r = 0.20 indicating that perceived *explicit connectivity* is higher in the FU group (Figure 2). We investigated if this difference was higher in one of the three learning locations. We found that *Explicit connectivity* is significantly higher for FU in the workplace compared to LU in the workplace U(N_{LU} = 49, N_{FU} = 23) = 246,5 z = -3.851, p < .001, r = 0.45. No differences were found in school and intercompany course locations between FU and LU in terms of connectivity.

Figure 2
Frequency of use of e-DAP, across learning locations



4 Discussion

The e-DAP was used to different extent both in the professional and the educational contexts, with a higher frequency in the latter. However, apprentices who used the e-DAP frequently at the workplace had a higher perception of their VET educators' effort to make the connectivity explicit across learning locations. These results are in line with the expected learning path of the e-DAP, inspired by the Erfahrraum model. The more apprentices collect traces of workplace experiences through the e-DAP, the more VET teachers can support explicit reflection on practice at school.

On average, the e-DAP was considered useful by participants and – in line with the expectations – its users perceived a higher level of connectivity across locations compared to a control group. In future, we are going to compare the e-DAP results with those collected from other tools developed in the Dual-T project. Moreover, we are going to test the effect of the perceived usefulness of the e-DAP on apprentices' perception of *mutual knowledge* and *explicit connectivity.*

References

Akkerman, S., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of educational research*, *81*(2), 132-169. https://doi.org/10.3102/0034654311404435

Berglund, I., & Henning Loeb, I. (2013). Renaissance or a backward step? Disparities and tensions in two new Swedish pathways in VET. *International Journal of Training Research, 11*(2), 135-149. https://doi.org/10.5172/ijtr.2013.11.2.135

Caruso, V., Cattaneo, A. & Gurtner, J.-L. (2020). Exploring the potential of learning documentation as a boundary object in the Swiss vocational education and training system. *Zeitschrift für Berufs- und Wirtschaftspädagogik – Beihefte, Band 29*, 213-232.

Cattaneo, A., Motta, E., & Gurtner, J.-L. (2015). Evaluating a mobile and online system for apprentices' learning documentation in vocational education: Usability, effectiveness and satisfaction. *International Journal of Mobile and Blended Learning, 7*(3), 40-58.

Cattaneo, A., & Motta, E. (2020). "I reflect, therefore I am… a good professional". On the relationship between reflection-on-action, reflection-in-action and professional performance in vocational education. *Vocations and Learning,* 1-20. https://doi.org/10.1007/s12186-020-09259-9

Cattaneo, A., Gurtner, J.-L. & Felder, J. (in press). Digital tools as boundary objects to support connectivity in dual vocational education: Towards a definition of design principles. In I. Zitter, E. Kyndt & S. Beausaert (Eds.), At the intersection of (continuous) education and work. *Practices and underlying principles*: Routledge

Engeström, Y. (2015). *Learning by expanding*. Cambridge University Press.

Griffiths, T., & Guile, D. (2003). A connective model of learning: The implications for work process knowledge. *European educational research journal, 2*(1), 56-73. https://doi.org/10.2304/eerj.2003.2.1.10

Hämäläinen, R., & Cattaneo, A. (2015). New TEL environments for vocational education – teachers' instructional perspective. *Vocations and Learning, 8*(2), 135-157 https://doi.org/10.1007/s12186-015-9128-1

lleris, K. 2011. *The fundamentals of workplace learning. Understanding how people learn in working life.* Routledge.

Kilbrink, N., & Bjurulf, V. (2013). Transfer of knowledge in technical vocational education: *A narrative study in Swedish upper secondary school. International journal of technology and design education, 23*(3), 519-535. https://doi.org/10.1007/s10798-012-9201-0

Mauroux, L., Dehler Zufferey, J., Rodondi, E., Cattaneo, A., Motta, E., & Gurtner, J.-L. (2016). Writing reflective learning journals: Promoting the use of learning strategies and supporting the development of professional skills. In G. Ortoleva, M. Bétrancourt, & S. Billett (Eds.), *Writing for professional development* (pp. 107-128). Brill.

Schwendimann, B., Cattaneo, A., Dehler-Zufferey, J., Gurtner, J.-L., Bétrancourt, M., &

Dillenbourg, P. (2015). The 'Erfahrraum': a pedagogical model for designing educational technologies in dual vocational systems. *Journal of Vocational Education & Training*, *67*(3), 367-396. https://doi.org/10.1080/13636820.2015.1061041

Schwendimann, B., Kappeler, G., Mauroux, L., & Gurtner, J.-L. (2018). What makes an online learning journal powerful for VET? Distinguishing productive usage patterns and effective learning strategies. *Empirical Research in Vocational Education and Training, 10*(1), 1-20. https://doi.org/10.1186/s40461-018-0070-y

Star, S. L. (1989). The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. In L. Gasser & M. N. Huhns (Eds.) *Distributed artificial intelligence* (pp. 37-54). Morgan Kaufmann. https://doi.org/10.1016/B978-1-55860-092-8.50006-X

Strahm, R. H., Geiger, B. H., Oertle, C., & Swars, E. (Eds.). (2016). *Vocational and professional education and training in Switzerland. Success factors and challenges for sustainable implementation abroad*. hep Verlag.

Biographical notes

Francesca Amenduni is Senior Researcher in the Area Educational Technologies in VET programs at SFIVET and Senior Project Manager in Teacher Continuing Training. She is a member of the SC of the EDEN Network of Academic and Professionals. Her research interests are related to boundary crossing, professional learning, reflective skills and digital technologies in education and VET.

Dr **Alberto A. P. Cattaneo** is professor and head of the research field "Educational Technologies in VET Programmes" at SFIVET. His actual main research fields concern the integration of ICT in teaching-and-learning processes, reflective learning in VET, instructional design, multimedia learning, teacher education and their professional competence development, in particular related to digital competence.