Teachers' Interventions and Knowledge Creation in a Master 'Learning & Innovation for Teachers in Vocational Education'

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Abstract: The study concerned students working in the Masters program Learning and Innovation during a year related to three themes. In this master program the principle of knowledge creation is an important pedagogical starting point. Teachers translate the principles in their personal practical didactical handling, which is recognizable in the difference of passive, and active knowledge building activities. These activities do not predict very well the students' activities. Density indications of the student knowledge building community should suggest not being to active and just reading students' notes. However preliminary results of qualitative student conversations suggest the opposite. Analysis indicates an increase in the quality of collective knowledge development.

Introduction

School leaders are confronted with a deficiency in teachers' competence related to their educational knowledge about learning and instruction, and to their research skills for evidence informed process of continuous improvement of educational practice. The two-year Master 'learning and innovating' aims a professional development of teachers in vocational education and knowledge workers who aspire a leading role in the process of educational progression. Students work in communities of practice to prepare and implement an innovation and praxis oriented research, while in blocks of four months developing their theoretical knowledge in knowledge communities concerning topics of team development, educational psychology, teaching (didactics), interpersonal acting, environment awareness and project management. Teaching in the master program is based on constructivist principles. This not only relates to the discussion between constructivism and direct instruction (Tobias and Duffy, 2009), but especially to approach of knowledge building (Bereiter, 2002) and knowledge building principles (Scardamalia, 2002a). Knowledge creation leads to another learning orientation than the traditional 'belief mode' of learning. It leads to a 'design mode' of learning, where ideas are approached as less fixed and given, but more approached by assessing their development potential within the collectively improvement of these conceptual artifacts within and for the community (Bereiter, 2002). Although principles are well described for teachers it is searching how to incorporate them in their style of teaching and student coaching as well to find out what works? A lot of studies on the issues how to structure or to interact more active or indirectly do not focus on the level of the development of professionals. Questions are therefore:

- What is the influence of teacher's role and interventions in this process? Are teacher style differences recognizable in their interaction to students? Do students' activities vary over the theme-periods? Do the teacher interventions predict the students' activities?
- Do students go from a 'belief mode of learning' towards a 'design mode of knowledge creation'?

Method

The study followed students and teachers during a year ecological valid, by intervening as less as possible. Data was registered from log files. Teacher's style and their handling with knowledge building principles come forward from a natural peer session. Students followed three themes. The first one in the period September until December; the second from January until half April, the last theme from half April until end of July.

Subjects

The group under study consisted of 3 teachers and 20 students with a teacher education bachelor grade or equivalent. All students work in vocational education or business (human resource development). Their age ranges from 24 to 57, two thirds are female and the regional spread is great.

The Master Context

Students need to have a minimum of two years working experience and must be involved in a educational innovation activity to enter the part-time master program (20 hours study load a week during two years). Monthly there was a two-day meeting of 'community of learning and knowledge building which included (guest) lectures, workshops, face-to-face knowledge creation conversations. In those two days students also exchanged information and experiences in 'communities of practice' about their ongoing innovative projects and research preparations. In between these monthly meetings, students learned and where engaged in

improving their understanding, their ideas, their knowledge together by conversation on the e-environment Knowledge Forum (KF) (Scardamalia, 2002b).

Data & Analysis

The conversation data in KF is subject of quantitative and qualitative analysis. Three theme periods vary on content, e.g. team development, Educational psychology and Pedagogy, but also in the way teachers intervened e.g. more or less directed and intensive.

Dependent variables where basic knowledge building measures generated by analytic tools embedded in KF: Notes created; Build-ons created; Annotations; Notes read; Notes revisions; views worked in; supports used; Rise-aboves created; problems worked on; notes with key words; keywords used and references created. Measures are also cumulated per theme period as a total measure. Teachers' variables are based on social network analysis (SNA): the number of notes read, build-on student's notes; references created; annotations linked to each student. A split is made by two variables related to notes of students read on the one hand and build-on, reference, and annotations on the other hand per theme period. The SNA also make some density data available.

MANOVA, ANOVA and Regression analysis were done with SPSS. In order to get a sense of how the knowledge creation process evolves and the conceptual quality of the discussions progresses, qualitative analysis of the database is carried out in addition. Four knowledge conversations in KF are subject of these analyses. The analyzed knowledge conversations had approximately equal size (average of 9 contributions). Besides the size also persons' ego-network strength at the end of the first period was a criterion. The conversations relate to the three themes. The qualitative analysis concerned: *1). Propositional/conceptual analysis:* displaying the content at the level of key concepts and propositions (relations between concepts) in the form of concept maps (Novak & Canas, 2008). This analysis is limited to propositions around key concepts related to first 2 theme periods *2). Socio-affective and regulative aspects of the contribution*: utterances of interpersonal nature that accompany the cognitive component of the contributions (the propositions) or regulate/direct the conversation (Kleine Staarman, 2009). *3). Analysis of the perspective or context* from which participants derive their propositions and which gives 'weight' to their contributions. E.g. explicit references to literature, referring to implicitly assumed collective knowledge, private or personal experiences or opinions, the context of their work place or their study and contributions of earlier date by themselves or classmates.

Instruments

Knowledge Forum is an asynchronous computer mediated communication (CMC) technology that supports the processes of knowledge building (KB). It facilitates collaborative knowledge-building strategies, textual and graphical representation of ideas, and reorganization of knowledge artifacts (Scardamalia, 2004). KB is a process of creating, testing, and improvement of ideas, e.g. conceptual artifacts. Scardamalia (2002) proposes 12 principles of KB: Real ideas and authentic problems; Improvable ideas; Idea diversity; Rise above; Epistemic agency; Community knowledge, collective responsibility; Democratizing knowledge; Symmetric knowledge advancement; Pervasive Knowledge building; Constructive uses of authoritative sources; Knowledge building discourse; Concurrent, embedded, and transformative assessment. Contributions can start from a new question or idea or build on previously placed contributions or to 'rise aboves'.

Teachers

The KB-principles guided teachers with respect to their personal style. During a collegial session teachers who did not yet teach in the master program interviewed their peers on how they handled the principles. Interviews where recorded, noted and analyzed collectively. Secondly the conclusions where checked on basis of principles description (Scardamalia, 2002a) and a characterization was setup. The latter was checked by the teachers if it reflected their teaching. (see table 1). The characterization shows that the teacher of team development facilitated more at the background. The educational psychology teacher has more structuring and student challenging interactions and the teacher of the didactical theme is even more directed on structuring and building on student's ideas.

Tabel 1: The teachers' actions related to the knowledge building principles.

KC Principles (Sardamalia)	Team development 'more at the background facilitating'	Educational Psychology 'more structuring and challenging interactions'.	Pedagogy, Instructional design 'Jig saw approach'
Real idea, authentic problems	Students' authentic questions are leading;	Development of your own vision is leading	Question: How to organize and facilitate learning in education and how to facilitate this in the professional situation.

Improvable ideas	Every idea is worth full and can be build on; student directed	Care about safety in the group to build on	Professional product oriented: curriculum analysis; advice; colleague study day
Idea diversity	Ordering of ideas, breadth of ideas and new information;	Building on student's notes by suggesting, explicating contradictions	Building on a pre-structured visualized mind map
Rise Above	Guiding writing a paper F2F	Working on a vision; separating main en side issues; building mental and a theoretical model	Refining the mind map
Epistemic agency		Self responsibility	
Community knowledge	During month of the Studium	Collective responsibility	Collectively exchange with colleagues
Collective responsibility	Networking outside curriculum activities	Group responsibility, stimulating use of sources; critical peer reflection	Jig saw groups
Democratizing knowledge	Studium	Studium	Studium; organizing a study day for colleagues
Symmetric knowledge advancement	Interaction with guest speakers	Sharing of knowledge, sources and ideas	Preparation and results reflections in relation to guest speakers
Pervasive knowledge building	Searching to students' own problems		Meetings at students' workplaces
Constructive use of authorative sources	Guest speakers also afterwards	Curriculum literature	Literature guest speakers (the author of the core book in the course)
Knowledge building discourse	KC-talking during F2F meetings	KC-structuring in F2F and KF	KC-structuring in F2F and KF
Embedded and transformative assessment	Clustering of notes Face to face discussion to create a rise above	Feedback to improve notes, feed forward by opening perspectives	Strong interventions in KF (content, referening advice, regulating on idea diversity and autoritive sources.

Results

Are Teacher Style Differences Recognizable in Their Interaction to Students on Bases of the SNA-data?

On the teacher data a GLM repeated measurement was carried out with Theme, Teacher and Amount of reading students' notes and Amount of Building on/referring on students' notes as within variables. The analysis revealed a significant main effect for Reading (M=15; Se= 2,06) and Building (M=8; Se=.14), F=54,3; 1,18;P<0.001). (see fig 1 and 2). The fact if teachers were active teaching in a theme-period has a significant effect on their activities which is revealed by a significant interaction of Theme and Teacher Green house-Geisser F=12,44; 4,18; P<0.001). Mauchly's test indicated a violation of sphericity $\chi^2(9)= 54,3;P=0.000$). Multivariate test was significant Pillai's Trace F=9,08 (4,15); P=0.001). So probably difference between themes is significant. The amount of teachers' reading and building-on depends on the fact if they are active teaching in the theme-period or not, as is revealed by the interaction effect between Theme and Read/Build-on F=3,35 (2,18);P<0.05. This later effect is not equal for each teacher as is indicated by a significant interaction effect of theme, Teacher, Reading/Buildon Greenhouse-Geisser F=8.73 (4,18);P,0.003). Mauchly's test indicated a violation of sphericity $\chi^2(9)= 54,3;P<0.001$). Multivariate test was significant Pillai's Trace F=9 (4,15); P=0.001). So it is realistic to be confident that the interaction effect is significant. Teacher reading
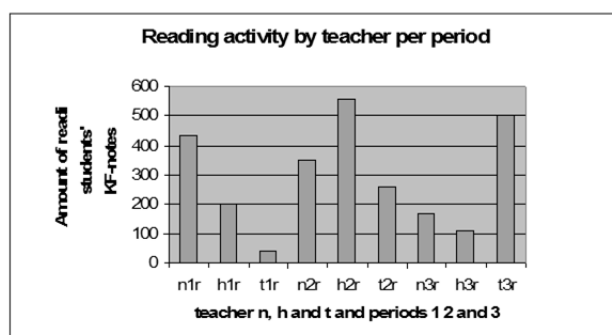

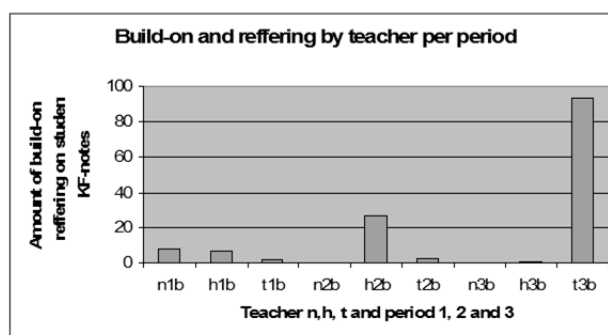Figure 1. Teachers' Students' Notes Reading per Theme-period.

Figure 2. Teachers' Building-on and Referring on Student's Notes per Theme-period.

M_{theme1}=50.05; Se=7,55; M_{theme2}=45,77;Se=7,55; ; M_{theme3}=42,22;Se=7,55 and Teacher buildon/referring ; M_{theme1}=0,42;Se=0.78; ; M_{theme2}=1,84;Se=0,78; ; M_{theme3}=5,21;Se=0,78.

Do Students' Activities Vary over the Theme-periods?

On the teacher data a GLM repeated measurement was carried out with Theme as within factor and 12 knowledge building activities: notes contributed; build-on; annotations; note read; note revisions; views worked in; supports used; rise above; problems worded in; notes with keywords; references created. There was a main effect of Activities (Greenhouse-Geisser F=69.62 (11, 29,268); P<0.001). Mauchly's test indicated a violation of sphericity χ^2(65,252)= 514,25;P<0.001) for activities. The multivariate test was significant Pillai's Trace F=11,055 (11,6);P<0,004). Activities also vary per theme as is indicated by an interaction effect theme x activities (F=2,82 (22,352); p<0,001).

Do the Teacher Interventions Predict the Students' Activities?

Three stepwise multiple regression analysis where carried out with as dependent variable the Total students' activities per theme and the independents the teacher Reading activities and Build-on/referring activities. Concerning the first theme the activity of theme1-teacher was not in the model. In the model was the reading activity of the Theme2-teacher: Constant B =272,94; SE B= 53,94; Theme2-Teacher Reading activity B=11,03; SE B=4,21; β=0,55. R^2=.30 for step 1, Δ R^2=.30 (F-change=7,12(1,17);P<0.02;Durbin Watson 1,98). Concerning theme 2 also the activity of theme2-teacher was not in the model. . In the model was the reading activity of the Theme3-teacher: Constant B =134,32; SE B= 68,41; Theme2-Teacher Reading activity B=18,17; SE B=4,29; β=0,73. R^2=.53 for step 1, Δ R^2=.53 (F-change=17,92 (1,16);P<0.01;Durbin Watson 1,91).Only in the third theme the activity of theme3-teacher was in de model, both reading and build-on/referring activities the later with a negative relationship. Step one: Constant B =84,41; SE B= 48,91;Theme3-teacher activity Reading students notes:; B=12,23; SE B=1,35; β=0,91. Step two: Constant B =97,47; SE B= 42,05. Theme3-teacher activity Reading students notes:; B=15,33; SE B=1,65; β=1,15; Theme3-teacher activity build-on/referring on students notes:; B=-19,03; SE B=7,22; β=-,325. R^2=.89 for step 2, Δ R^2=.0,05 (F-change=6,95(1,15);P<0.02;Durbin Watson 1,6).

Socio network analysis (SNA) were carried out per theme-period on the variables Reading each other notes, Build-on, Reference and Annotation. A second without Reading notes. Actually the high density is getting less during the year despite that teacher's activities of theme3-teacher predicts better students' activities.

Table 2: Density indications of the student teachers community per theme-period.

Theme	Network edges	Density	Connected to	Level read	Level build-on	Level reference	Level annotate
1	227	98,26%	52	101	5	3	1
2	208	90,04%	57	68	8	2	1
3	181	78,35%	0	135	8	7	1
1 no reading	95	41,12%	7				
2 without reading	80	34,63%	17				
3 without reading	64	27,7%	0				

Do Students Go from a 'Belief Mode of Learning' towards a 'Design Mode of Knowledge Creation'?

Qualitative discourse analysis where carried out to gain more insight in the process of knowledge creation and a potential move towards a design mode of learning. Four conversations where selected of three students on basis of the density of their ego-network. The qualitative analysis of the three knowledge conversations shows that the conversations related to Educational psychology in contrast to team development the number of words per contribution and the number of propositions increased, although the number of participants decreased to four (compared to four and nine related to team development). Moreover, in contrast to the first period (team development) the contributions related to Educational psychology no longer include attachments without added writing about the core message of it by the student. So students articulated more the essence themselves. It is also noticeable that almost all students' contributions enclose regulative and affective expressions. It is also remarkable that the student who started the conversation with a 'new contribution' also contributed a kind of reflective, evaluating contribution at the end. These shifts indicate a move towards a design mode of learning.

The conversation related to Educational psychology shows a clear distinction: students succeed to build complex relations between the different contributions of themselves and that of others during the conversation.

The analyses conversation related to the third team clearly started with a mandate by the teacher. There is more intensive teacher coaching. Students did not build on the four interventions of the teacher. More resources where used in argumentation and less opinions. No attachments were added in the notes in order to 'transfer' any content. Scaffolds do not always correspond with the nature of the contribution. It looks like if there is a relation between the portion of contributing to the community, collective knowledge development and the amount of social and regulative comments. Students who contribute a lot of propositions do this by simultaneously contributing social-affective and regulative comments (see fig. 3).
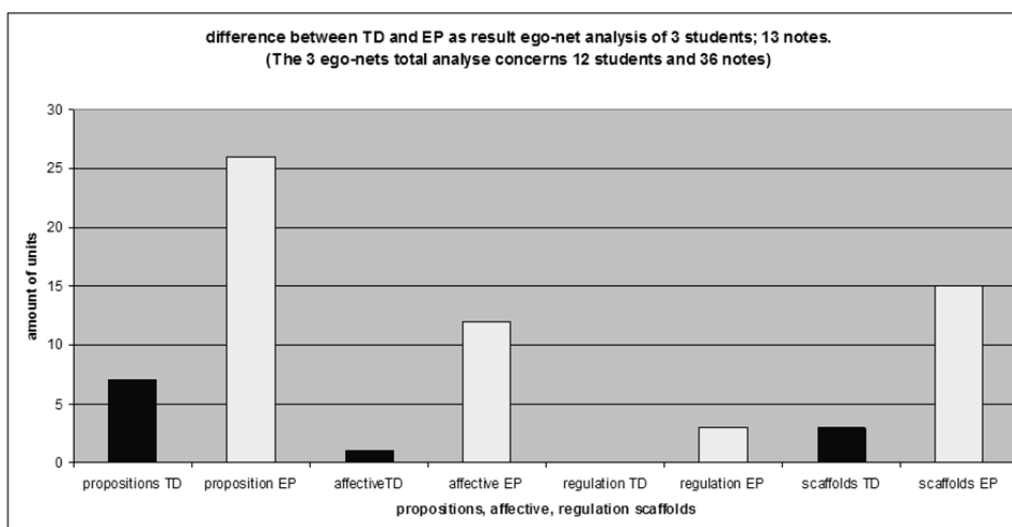

Figure 3. Difference between Propositions, Affective and Regulative Comments and the Use of Scaffolds.

Conclusions

Students' basic knowledge building activities varied across theme-periods during the year. Students' activities are not very well predicted by the teacher activities 'reading student notes' of the actually teaching teacher but more by the reading by other teachers. This might be due to the fact that the other teachers are also mentor of students. This is weird while reading is a rather passive invisible activity. However it might be that in the face-to-face meetings students recognize teachers show their knowledge of the notes in their teaching or mentoring. Only in case of the third teacher his activities predict the student activities. But the more direct activities of build-on and referring have a negative relation with it. So the more building-on and referring as a teacher do, have a deceasing effect on student activity. This is in line with the density of the student community, which is most dense in the first theme-period and decreases the more the teachers are active during theme period 2 and 3. So one could advice to be more at the edge of the community as a teacher. The preliminary qualitative knowledge building conversation analyses however show the opposite. The more the teachers are active the conversations show a deeper level and students move towards a design mode of learning. We concluded that the quantitative results are not directly interpretable in a one to one relation to the quality of knowledge building. More study and analysis are needed to shed light on this relationship.

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