CORF®: Collective Educational Research Facility
Design of a Platform Supporting Educational Research as an Integral Joint Effort of Researchers and Teaching Professionals

Ruurd Taconis
Eindhoven School of Education, Eindhoven University of Technology, Den Dolech 2, Eindhoven, The Netherlands

Keywords: *CORF*®, Educational Research, Theory-Practice Gap, Research Object, Research Sharing, Data Sharing, Interoperability, Open Publishing.

Abstract: In educational research, like in other research fields, there is a growing call for sharing data and results. The public interest in results is clear, and much of the research is done using public money. Besides this, educational research a gap exists between the research community and research outcomes on one hand, and secondary school teachers, schools and educational practice on the other. *CORF*® (in English: Collective Educational Research Facility) is a web-based platform that supports the sharing of research instruments and research data within and across research projects. *CORF*® community members may be professional researchers as well as educational practitioners. In this contribution, the concept of *CORF*® is presented and its major design characteristics are outlined. The system was realized as an internet platform and employed by various researchers, teachers, and student teachers. A general evaluation and three use-cases are presented leading to conclusions on the strength and weaknesses of the platform and conditions for adequate use in practice.

1 INTRODUCTION

The call for increasing the pay-offs of publicly financed research is getting louder continuously. In this trend 'open access publishing' and 'data sharing' often come to the fore. ICT holds promises for making research more efficient, increasing the speed of knowledge production, and allowing for a more effective spread of results. The European Community has set a clear course toward data sharing and open access publications (Horizon 2020), as have various governments, research funds, and research organizations.

This development also concerns the field of educational research. In the domain of educational research, researchers and practitioners have been struggling with a theory – practice gap for years. This probably hinders both theoretical progress, but it definitely limits the innovation of educational practice (Broekkamp and Van Hout-Wolters, 2007). Practitioners often have a low opinion off the merits of educational research in practice (e.g. Gitlin et al., 1999).

Attempts have been made to narrow this gap. The Dutch government for example has restructured the way educational research is funded. The newly formed in NRO-institute (http://www.nro.nl/) tries to create closer ties between educational researchers and practitioners (Admiraal, 2013). In various Western countries secondary school (student) teachers are encouraged or even demanded to engage in research projects (Sinnema et al., 2011). The aim is to increase teachers' quality by supporting their practical understanding of educational research, and to empower teachers with tools to improve their educational practice continuously. Teachers are continuously stimulated to adapt and develop their professional practice.

Hence, the educational field could benefit from ICT tools and systems that could help:

- to boost data sharing, open access, and the effectivity and efficiency of educational research in general,
- to bridge the gap between educational research and educational practice,
- to support (student) teachers in secondary school to perform high standard practical educational research and learn from it.

To this end, the *CORF*® system (a Dutch acronym

Taconis R..
CORF® : Collective Educational Research Facility - Design of a Platform Supporting Educational Research as an Integral Joint Effort of Researchers and Teaching Professionals.
DOI: 10.5220/0005430802350245
In *Proceedings of the 7th International Conference on Computer Supported Education* (CSEDU-2015), pages 235-245
ISBN: 978-989-758-107-6

which reads in English: Collective Educational Research Facility) was designed and built. Its design will be described together with use-cases leading to a first evaluation.

2 THEORY

Four fields of research are relevant for this paper: 'open access and sharing of research', 'online questionnaires', 'educational research' and 'teacher research'.

2.1 Access and Sharing

The concepts of sharing information and connecting people are at the very heart of Information and Communication Technology. The main implications concerning research are Open Access en sharing of results.

Open Access implies unrestricted online access to peer-reviewed scholarly research. Open access increases the effectivity of research (Harnad and Brody, 2004). Open Access also disrupts established structures in information markets concerning journals, publishers and knowledge institutions. However, it creates new audiences for research outputs as well. In the educational domain, for example, practitioners traditionally not always have direct access to research outcomes, although it is clear that they should be a - if not the - main beneficiary. By creating new audiences, Open Access is likely to create new demands on publication formats. For example, enriched publications that may include datasets that can be interactively 'explored' and/or convincing visualizations that give insight in key ideas may help practitioners to understand and employ research outcomes.

Concerning data sharing, interoperability plays a central role. There is little benefit in sharing data that cannot be used by others. Standards play a key role in interoperability and may also help in preserving data. Technical standards are needed (e.g. concerning coding and transferring data). These allow data to be stored and transferred effectively and that are readable by a variety of systems.

However, for research data to be useful to others, we need domain related standards as well. These should for example describe 'when', 'how' (instrument) and 'from whom' (sample) the data were collected (Arzberger et al., 2004), making the data meaningfully interpretable.

It is hard not to notice that in the field of education much effort has been made to innovate practice by implementing ICT. This implementation of ICT seems to focus almost exclusively on creating effective technology-rich educational arrangements, sharing learning materials, and organizing and supporting learning through ICT. Examples are the creation of open collaborative learning environments, MOOC´s, and serious games etc. Only a small fraction of the effort focuses on the support and strengthening of *research* of learning processes and education using ICT.

Among the relatively few ICT experts that have addressed the process of educational *research* is Hunter (2006) who proposes 'Scientific Publication Packages' as a rich, meaningful and transferable units of research information. Goble, de Roure and Bechhofer (2013) and Belhajjame *et al.* (2014) propose and define so-called 'Research Objects', serving roughly the same purpose as Hunter's 'scientific publication packages', but the goal of being 'shared' rather than being 'published'. These and other projects have provided ontologies for describing education research and its components.

2.2 Online Questionnaires

Online surveys and questionnaires are increasingly popular in various fields and for various purposes. Social media often include tools to create polls and questionnaires. Professionally, online surveys appear particularly popular for in company monitoring purposes, market research and customer experience research. A large number of online survey systems exist (e.g. Satmetrix, FluidSurveys, Lime survey, Survey Monkey). Also in the domain of research some specialized systems can be identified (e.g. Archer, Qualtrix).

With the exception of Qualtrix which includes a shared but static questionnaire library, all platforms seem to follow the strategy of each client building his own questionnaires (Best Survey Software Reviews and Comparisons, 2015). Although some platforms allow sharing of survey outcomes, the platforms do not support active sharing of raw data and/or questionnaires between various clients.

The potential advantages of Internet-based collection of scientific data are numerous: low costs, reduced time investment, less travelling, quick and accurate data processing, easy reaching of (geographically) remote respondents, adaptive questionnaires, easily administrated lingual and/or cultural parallel versions, inclusion of multi-media elements (e.g. including small video's to react on), and the use of new questionnaire formats (Zhang,

2000).

On the other hand there are a number of risks These include: biased sampling, and biased responses (e.g. by self-selection mechanisms), large nonresponse, responses by unintended respondents, multiple responses by the same respondent, invalid responses, unwanted revision of previously given answers (e.g. after comparing with answers previously given to other questions), and generally uncontrolled conditions during completion of the questionnaire (e.g. other persons influencing the answers). Various authors have described these risks and possible measures to be taken (Zhang, 2000; Gunn, 2014; Bosnjak, 2012; Furlan and Martone, 2012).

2.3 Educational Research

Traditional mainstream educational research heavily draws on psychology, cognitive and social psychology in particular. Most educational researchers are oriented accordingly: towards the construction of generalized theories and models (Broekkamp and Van Hout-Wolters, 2007).

Low Level of Standardization

Unlike large parts of modern day psychology and the exact sciences, key concepts in educational research are defined in various local or idiosyncratic ways. As a result, general accepted standardized measuring procedures or instruments are almost absent. Even for key-concepts such as knowledge, motivation or learning-styles a wide variety of instruments exist, all employing their own definitions. For example, Kleinginna and Kleinginna (1981) listed 92 definitions of motivations! This richness is partly beneficial and in accordance with the multidimensionality of educational processes and learning. However, it also makes that most datasets are usable only by the particular researcher who collected these data. Sometimes, instruments and data collection procedures are described incompletely or without enough detail. Such 'method obfuscation' (Goble, de Roure and Bechhofer, 2013) would block meaningful data sharing.

From a logical perspective, the ´local´ and sometimes idiosyncratic approaches form a paradox with the intention to build generally applicable educational theories. Building such theories upon locally collected and/or idiosyncratic data seems impossible. Hence, scientific progress in terms of general and empirically validated general educational theories probably requires generalized instruments and measuring procedures, as well as producing and sharing interoperable data sets.

Such a development may potentially lift educational research into a next 'epistemological phase'. It would create a situation known from other disciplines like biology, astronomy, physics or history. In those domains, data are collected using instruments and procedures (e.g. expeditions, telescopes, satellites, CERN) not created or owned by the local researcher. The researcher may actually not be the collector of the data at all. Data are 'bought' from researchers outside the research team, or come from library resources. In astronomy, for example, extend catalogues exist, containing raw data on thousands and thousands of stars. It is critical that these are all collected using precisely defined and shared measuring procedures and instruments of undisputed validity and quality. Interoperable data require standardized and shared instruments and measurement procedures.

Unsatisfactory Impact

Various factors may contribute to the limited impact that educational research has on educational practice. A first would be the strict division of research communities and practitioner communities. These communities have contrasting work-processes (reflective versus pragmatic), incentives (production of formal knowledge versus practical managing the learning of students) and rewarding mechanisms (scientific publications verses happy and successful students). These are 'two worlds with complementary approaches and interests'. For example, Dutch secondary school teachers generally do not have access to the leading Dutch journal for teacher trainers, since it is 'members – only'.

A second reason would be the educational researchers' orientation towards building general theories (Broekkamp and Van Hout-Wolters, 2007). Many researchers do not have experience as an educational practitioner. Educational researchers may be over-confident concerning general theories, regarding practice as a specific case to be described using general theories. They may not always be aware of essential characteristics of particular educational situations. This can lead to miscommunication when communicating with practitioners.

In addition, the multitude of definitions and measurement procedures, and the detailed – and sometimes semantic - arguments these may provoke, can create confusion that constitutes yet another factor limiting the practical impact of many potentially powerful findings in educational

research. Hence, we presume that standardizing e.g. key concepts, instruments and measurement procedures may help to increase the usability of educational research for practitioners.

2.4 Secondary School Teacher Research

Unlike the interest of educational researchers in general theories, a practitioner's perspective strongly focusses on the effectual understanding of the current and local situation. Theories that apply/work 'here and now' are preferred. The professional aim for practitioners may be to improve their knowledgeable professional performance sometimes called 'praxis'. This 'praxis' results from a productive melt of theoretical insight and practical competence which can be improved by practical research sometimes denoted as action research (Ax et al., 2008).

Action research can be defined as 'a process in which teachers investigate teaching and learning so as to improve both their own and their students' learning, to the benefit of their school'. Here the focus is on understanding and improving the *current* and *local* practice, and not on producing general theories or models. Moreover, 'general' models may sometimes be inadequate for the specific situation the practitioner finds himself in.

Schools and governments too want (student) teachers to be involved in research for several reasons (Vrijnsen - de Corte, den Brok, Kamp and Bergen, 2013). They expect that doing research will make teachers more aware off possible flaws in their professional performance, and that it will guide and inspire them to improve. Hence, a 'closed feedback loop' involving monitoring, reflection and renewed education is considered essential for practitioner research. It is about monitoring and evaluating the effects of the researcher's own actions in the role of practitioner with the aim of improving practice.

2.4.1 Factors Hindering Teachers' Research

Secondary school teachers may experience various problems in doing practitioners research.

Missing Research Context Limits Teachers' Research

First, teachers picking up research may find themselves isolated. They are not part of an educational research environment (Imans, 2014). Colleagues may sometimes even be negative about (doing) educational research, or may regard it as a privilege instead of a supplementary but serious and demanding task. Tight and compelling schedules may make doing research even more difficult.

Up-to-date Information and Guidance Are Needed

Teachers in secondary schools are not always well-informed about the recent progress in educational research. Their focus is on practical improvements and research result tends are often primarily presented from a researchers perspective. Presenting research findings for teachers is difficult. It is hard to build a bridge between the theoretical world and the practical world. For researchers publishing outside scientific journals is usually undervalued and unrewarded.

Hence, teachers are at risk to do projects that are scientifically 'naive' or that suffer from serious methodological flaws. Teachers may - quite legitimately - want to focus on practical knowledge, 'local' (non-generalized) understanding and improving of their praxis. However, only *valid* research will truly help deepen insight in what is going on and in how to improve as a practitioner.

Need of Concrete Resources

Apart from this, teachers may suffer from a lack of research tools and resources. An extensive body of literature exists aiming at the support of teachers in doing practical research in the form of books (e.g. Shagoury and Power, 2012) or websites (e.g. CoreIdeas, 2014). Inspection shows that materials and courses focus on the systematic setup of academic research. Various elements crucial for practitioners research such as 'how to use research conclusions to build a valid action plans' and 'convincing your colleagues', get little attention. Some courses honour the essential role of 'closing the feedback loop' and address practical research approaches such as action research (Ax et al., 2008) and design research (Gravemeijer and Cobb, 2006).

In all cases, actual concrete resources for doing research, e.g. questionnaires, instruments and statistical tools that fit the teachers' particular research situation, are quite rare. A lack of such concrete resources may stimulate the use of self-constructed instruments. This is time-consuming and most often results in instruments that lack sensitivity, validity or reliability. This may limit teacher professionalization and may lead to meaningless or misleading results. Providing teachers with concrete validated instruments and other concrete resources may help them to professionalize more effectively and would make a

more direct contribution to school innovations.

Instruments

Nevertheless, various instruments developed by educational researcher are practical and valuable diagnostic tools for teachers. The various instruments produced at the SMEC institute are convincing examples that are used worldwide (Fraser, 2012).

Making available such instruments may boost secondary school teacher research and professionalization, particularly when theoretically instruments can be adapted to the teachers specific situation/needs. In particular when presented in a practical and compact format, making it easy to administer the data or to compare the outcomes with results attained elsewhere. Using online questionnaires would be an effective and practicable approach (Birnbaum and Reips, 2005). Practitioner research could benefit from easy-to-use instruments derived from scientific counterparts (Feldman, 2007).

2.5 Focus and Research Aim

In this paper, we will describe the CORF® system and three use-cases. We end with conclusions on the merits, weaknesses and possibilities of the CORF® system. We will particularly focus on bridging the gap between educational research and educational praxis, facilitation of teacher research and stimulating scientific progress in educational research. Finally, we will discuss some directions to improve the system still further.

3 CORF®

The *CORF®* system is an Internet platform that facilitates (student) teachers and researchers to collaborate in doing educational research.

It employs a database containing research projects each comprising various objects such as instruments, data sets and reports/publications. These objects can be shared within the *CORF®* community. Instruments typically are editable questionnaires that can be administered online. Using *CORF®* these can be administered as online questionnaires to respondents inside or outside the community. Hence, *CORF®* defines a working environment for building, sharing and adapting questionnaires, data and other research components.

For granting access, *CORF®* employs role-based access control strategy. The various roles each require the user to accept a specific user agreement. Important roles and their rights (shown in italics) are (Taconis et al., 2007):

- Anonymous: has the right to *see* 'open' instruments, data sets and reports, complete questionnaires anonymously;
- Respondent: has the right to *complete* instruments/questionnaires retraceable to the user account, *see* instruments, data sets and reports 'shared within the community';
- Instrument Administrator: has respondent rights + the right to *collect* data with existing instruments, (teachers may take this role when collecting data for a project they participate in)
- Author: has instrument administrator rights + the right to *create/share/adapt* instruments;
- Editor: has author rights + the right/obligation to peer *review* data sets, instruments and reports/articles.

In addition, CORF® users can make specific exception concerning visibility and sharing of the various instruments, data sets etc. they own.

3.1 Components and Functionalities

Key features of the CORF system are listed below. In the next sections these will be described more extensively.

Library of Active Online Instruments

- the active library contains various standard scientifically validated instruments,
- al instruments can be administered online.

Supporting Practitioners Research

- CORF® supports instrument types specifically tailored to teachers research (storyline, rep grid, etc.),
- online instruments produce an individualized response page that pops up immediately after completion of the questionnaire by a respondent. Its set-up is an editable part of the instrument that can be tailored as to produce detailed feedback to the respondents (Taconis, et al., 2014),
- individualized response pages can be made visible to the instrument-administrator,
- the collected data can be extracted to be processed in statistical software packages.

Sharing and Adapting Research Instruments

- (if permission is granted by the owner) instruments can be shared, copied, adapted, combined and made part of a user's own research project.

Sharing Data Sets

- (if permission is granted by the owner) data sets can be shared and made part of a user's own research project.

Sharing and Open Access Publication of Reports/Articles

- (if permission is granted by the owner) reports can be shared and can be published as open access articles.

Certificates

- instruments, data sets and reports/articles can be submitted to a board within the community for peer review

3.2 Concept and System Design

A key idea behind *CORF*® is that educational research is a collaborative endeavour. It is primarily performed in a team working on a project. However, research teams are part of a larger research community. Community members may play various roles in different teams such as inspirer, (potential) team member, source of knowhow, critical friend, formal evaluator, audience or customer. In educational research, teachers and schools should be included playing their role in this community.

As research projects progress various 'documents' are produced such as ideas, plans, hypothesis, assumptions, literature reviews, instrument, data sets, and report are created. In a classical approach to research, these are typically shared within the project team while some may be shared with close colleagues. However, by sharing with community members outside the project team and/or outside the circle of close colleagues, the efficiency of the research process can probably be increased. In particular when sharing instruments and data sets.

Hence, research projects within the *CORF*® system are conceptualized as a compound data objects comprising e.g. research plans, instruments, methodological schemes, data sets, reports etc. The platform facilitates sharing, the sharing of instruments, data sets and reports in particular.

Project teams in *CORF*® can import instruments and data sets from other research projects within *CORF*®. These shared objects can be combined with the team´s own instruments and/or data, or with data from yet another project. In theory, a project can even entirely draw on data sets from other projects. In this, the availability of the corresponding instruments is crucial for interpreting such data sets. If instruments are imported in a project, these can be readily used to collect new data. Alternatively, the imported instruments can be adapted and saved as 'new instruments', before new data are collected.

A key issue concerns the validity of online questionnaires. We think that that community approach taken by *CORF*® adequately counters most of the threats tot data quality since a key aspect of the hazards listed above comes from the lack of any link between the respondent and the research. In the community approach taken by respondents typically are linked to the research though not in a way influencing their responses. Respondents will typically be students a secondary school classroom, being asked by their teacher to complete the online questionnaires. In this the teacher typically acts as an instrument-administrator, supporting the cooperation of the students but not involved in the research itself. In addition, the CORF system provides various systems to prevents double or unwanted entries, such providing the teacher with a set of unique access codes for his students.

3.3 Database Ontologies

Within the CORF® database, the compound structure of ´research project´, comprises elements from three distinct ontological trees: instruments, data sets, and reports. Each carries its own attributes; metadata and addenda in particular. Other research components like plans and hypotheses are included within the metadata.

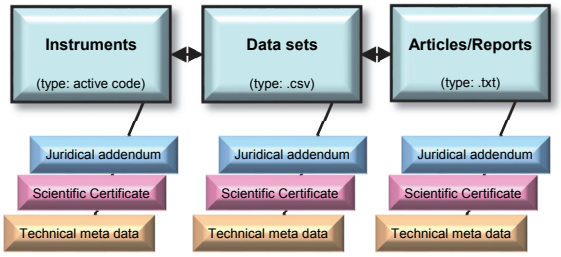

Figure 1: The compound object 'Research project'.

3.3.1 Instruments and Instrument Sharing

Instruments can be of various sub-types such as

'interview scheme', 'observation scheme', or 'questionnaire'. Instruments of the questionnaire sub-type can be actively administered as online questionnaires. Instruments as well as their parts (sub-questionnaires or items) can be shared through copying. Copies will be personal and can be adapted by the user (for other sub-types these features are not supported in the current CORF system). When copied, the juridical addendum also sticks to the copy while a scientific certificate is lost (no second scientifically certified copy can exist).

3.3.2 Data Sets and Data Sharing

Data sets are the result of administrating an instrument to a particular group of respondents. Data sets cannot be copied or edited and they are shared by granting access to another CORF user (not by copying). Typically, they are shared with the instrument owner, as an instrument is administered by another user.

3.3.3 Sharing Reports and Publishing Articles

In a way, research projects shared within the CORF® already constitute enriched and ´open´ publications – at least within the CORF community. Publishing a ´Research Project´ is creating an open publication freely accessible outside the CORF community. This requires review and accordance by the peer review board within CORF® as either a 'professional publication' or a 'scientific publication'. Since the related data and instruments are directly available in the CORF system, the publication is 'enriched'. Assessing the components, however, requires an adequate CORF account.

3.4 Metadata

For all three types of objects, metadata are attached within three categories (i.e. instruments, datasets and reports/articles).

Technical metadata comprise: version, family, date of production, last date of adaptation, etc. Educational metadata can significantly enhance the effective description, search and retrieval of online learning objects and educational resources (Chatzinotas et al., 2014). These comprise age of the student population, school type, school subject, etc.

The juridical addendum comprises information on ownership, authorship and rights concerning components. Juridical issues are also taken care of by through the role-based access control system, user agreements and privacy regulations. Qualifications in the juridical addendum may prevent particular actions such publishing externally or sharing.

The scientific certificate concerns scientific information on usability, scope of applicability/validity, sample size (for data) and issues of scientific quality.

3.4.1 Research Certificates

Research certificates are produced on request by a board installed within the CORF community that comprises high ranking academic researchers as well as practitioners. The board provides high quality peer review. Two types of certificates can be granted: 'scientific' and 'practitioner'.

The workflow for the certification procedure is implemented within the CORF system. It applies to each of the ontological object-groups separately. E.g. an instrument can get a scientific certificate indicating its scientific merits in terms of validity, reliability, sensitivity, reproducibility etc. for use within an indicated domain of applicability, against generally accepted scientific standards (Trochim, Donelly, 2006). The board typically needs data collected using the instrument to be able to judge this.

Also, data sets may be awarded a certificate. This requires the use of a certified instrument, proof of unbiased data collection procedure (e.g. controlled circumstances during data collection, respect for applicable codes of conduct), data quality (e.g. number of: missing values, cases with suspect data-patterns) and sample (e.g. within the instruments domain of validated applicability).

A project that reuses a certified instrument developed elsewhere may produce a certified data set, leading to a report which is scientifically certified. To acquire the latter the board will evaluate the whole research project (including instrument and data) in a way analogous to scientific journals reviewing submitted papers. Certificates of the 'practitioner' type are granted along the same lines, but with criteria that emphasise practical value over scientific merits.

Certificates are visible to all CORF users, and help them to select instruments for adaptation and/or reuse or data sets that they consider apt for their purposes. E.g. teacher may want to use scientifically certified questionnaires as a basis for constructing their own (no longer scientifically certified) questionnaires. Later on they may apply for the certification of these new instruments, e.g. on the

practitioner level.

3.4.2 Community

The CORF system defines a community. Various users may have interest in different issues, from different professional perspectives, and on different levels of proficiency. Members all bring to the CORF community their questions, expertise, instruments, data and research results. In return, they get answers, knowledge and support from each other. PhD-researchers, for instance, appreciate *CORF®* as a way of efficient data collection and as a way to connect more closely to their primary audience: teachers. Teachers and schools appreciate the opportunities to get easy access to research capacity that may be able to help them to solve problems emerging in school-practice.

Teachers and student teachers can improve their teaching and research skills while using data and instruments. They can also collaborate with other teachers as well as researchers.

4 EVALUATION

Currently, *CORF®* comprises over 2000 accounts and 350 projects. Over 20.000 questionnaires have been administrated. Approximately 20% of the activity is due to participating teachers, student teachers in particular. On the other hand, not all accounts are simultaneously active, and activity seems decisively stimulated by the adoption of the system by teacher training institutes for student teachers, PhD-projects and practical surveys and inquiries.

Various modes of using the system occur: using standard questionnaires for quick feedback, adapting and combining standard questionnaires, creating entirely new questionnaires, using specific practical instruments that are otherwise electronically unavailable (e.g. storyline - see below).

4.1 Survey and Interviews

We administered a small survey (n=360 on the general features and usability of the CORF-system. Apart from this, a series of interview was conducted with CORF users.

The interviews focused on the appreciation of the various components and aspects of the system. The interviews were structured and addressed a series of key issues: reasons/incentives to use *CORF®*, usability, the library of active instruments, particular instrument types (see below), administration of online questionnaires, instrument sharing/reuse, data sharing, the peer review system, publishing facilities, etc. Researchers as well as practitioners were interviewed.

The survey and interviews indicated that the CORF system was stable and performed adequately (Taconis, De Jong and Bolhuis, 2007). Some users reported difficulty in understanding how the system handled instrument-versions. It also became clear that general usability could be improved and the various options implemented were not always intuitively clear.

A main result from the interviews was that teachers and young researchers at the beginning of their careers appreciated the crossover between teachers and researcher. Teachers indicated that this was an opportunity for them to connect to researchers, and that this was of key value for them to participate. They also appreciated the library of instruments. On the other hand, they complained that 'there are not too many people around'.

These two groups of respondents also liked the possibility to share and publish without the high threshold that occurred when submitting to an official journal (Taconis et al., 2014). In particular informal papers, 'try-outs', presentations and other half-products that would otherwise "would be exclusively shared with my hard disk".

Senior researchers clearly had a different focus. These often had supervising roles in research rather than operational ones. These researchers appreciated the possibility of administrating questionnaires online because of low costs, efficiency and the availability of high standard instruments within the system (reusability). These respondents also liked the quick feedback pages, which they identified as a time-saving way to provide learners with the feedback.

From the interviews, it becomes clear that doing peer review of publications was not the participants' priority, in particular due to a lack of scientific status. However, it was widely recognized that the quality of instruments in *CORF®* should be easily recognizable, and that this required peer review.

4.2 Use-cases

Use-cases can illustrate the key characteristics of the CORF-system.

4.2.1 Use of Standardized Questionnaires

Figure 2 shows the metadata page on the

CLES-questionnaire (Fraser, 2012) implemented in de CORF library as an active online questionnaire. This instruments has been reused/adapted several times, both at a scientific level in PhD students, and at the 'practitioners´ level by student teachers.

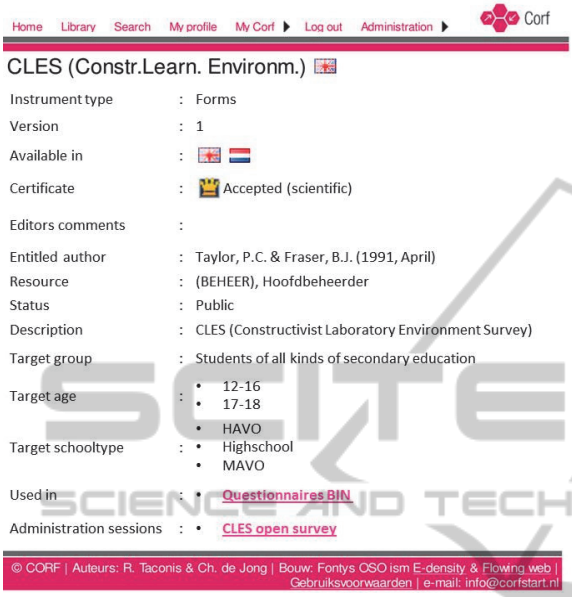

Figure 2: Metadata of the standard instruments CLES.

4.2.2 Storyline Instrument: Innovative Pract-icable Scientific Evaluation Instruments

'Storyline' is originally developed as an interview format. The general idea is that the respondent is asked to look back on a particular period of education and to draw a graph depicting the his/her development concerning a particular developmental aspect – typically knowledge or skill of a particular kind (Beijaard, 1995). The graph´s shape generally shows various bends, discontinuities, steep and/or curved sections, etc. These correspond to particular developmental events and circumstances. The respondent is subsequently asked to explain the shape of the graph (Figure 3). This reveals the mechanisms and circumstances the respondent considers relevant. The whole procedure forms a thorough and focused but time/consuming way to evaluate learning processes as perceived by the learner.

In *CORF®*, the time-consuming interview format is recast into a compact electronic format, which is a combination of the online drawing of the graph and answering an adaptive set of open questions that map the respondents' explanation. Moreover, the *CORF®* system offers immediate feedback to the

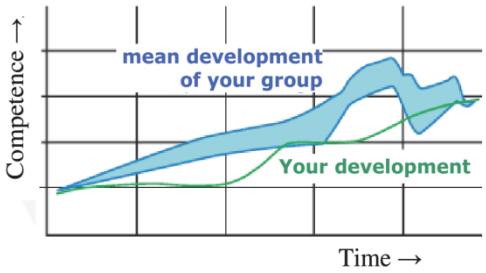

Figure 3: A Storyline diagram form CORF feedback (respondent's explanations no shown).

respondents as well as to the instrument-administrator, which includes a graph of the respondents' peer-groups average (self-perceived) development.

This practical format became popular with CORF users employing it for teacher training evaluation and research into the development of ICT use by science teacher.

4.2.3 QTI: Immediate Specific Feedback with Scientifically Established Instruments

A closed feedback loop is essential for teacher research. Each CORF questionnaire produces a

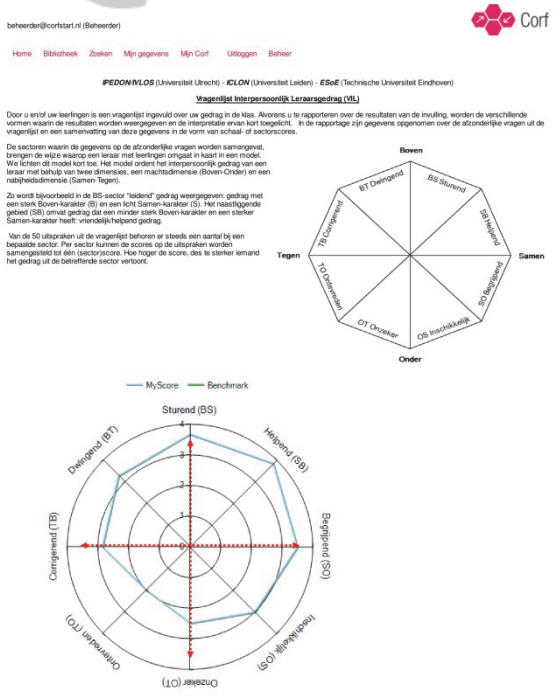

Figure 4: Immediate feedback for teachers (and students) on electronically administrated CORF questionnaires using diagrams and condition texts.

response page. This page can be tailored as to show individual scores, total-scale and sub-scale means to both the respondent and the questionnaire-administrator.

Figure 4 shows the example of detailed feedback in the case of the QTI-questionnaire (Questionnaire on Teacher Interaction – e.g. Wubbels et al., 2006).

5 CONCLUSIONS

The CORF system works reasonably well. The design and technical implementation match expectations on all key issues. Examples are the conceptualization of the compound object 'research project', juridical issues, metadata, administering questionnaires, sharing instruments.

A first points of improvement is making the handling of versions more transparent. Also the user interface could be improved. Besides this, the set of educational metadata could be further developed, i.e. by using ontologies developed elsewhere (Duval, 2001).

Concerning the first research question, we conclude that *CORF®* technically provides the facilities for data sharing and open access publications. It also recognizably boosts research efficiency as is well recognized by senior researchers. *CORF®* also clearly helps to promote the use of standardized tests amongst PhD students, in particular when supported by supervisors.

Concerning the second research question, both teachers and young researchers appreciate the opportunities mutually get in touch and the low threshold publication opportunities *CORF®* provides. The quick feedback page really adds value to the electronic questionnaires.

Concerning the third research question, we find that teachers appreciate *CORF®* for providing access to acknowledged instruments. Indeed (student) teachers started using scientific instruments, standard questionnaires from the library and storyline in particular.

Overall, however, the contribution *CORF®* makes to strengthening educational research and supporting teacher research appears limited. The CORF system as such performs adequately, but the scale of the active community seems too small to capitalize on the various opportunities offered.

Certificates, for example, are implemented in a well manageable way. Nevertheless, in a small community a uses can still judge the various instruments directly, and certifications appears as devious and the 'burden' of reviewing does not pay off.

It is observed that most CORF users are linked to a school or a teacher-training institute or research institute that actively promotes the use of *CORF®*. An obvious first step to enlarge the CORF community would be to involve more institutes.

REFERENCES

Admiraal, W. (2013). *Academisch docentschap: naar wetenschappelijk praktijkonderzoek door docenten.* (Academic teachers: practical scientific research by teachers). Inaugural lecture, Leiden University, Leiden The Netherlands.

Arzberger, P., Schroeder, P., Beaulieu, A., Bowker, G., Casey, K., Laaksonen, L., ... & Wouters, P. (2004). Promoting access to public research data for scientific, economic, and social development. *Data Science Journal*, *3*, 135-152.

Ax, J., Ponte, P., & Brouwer, N. (2008). Action research in initial teacher education: an explorative study. *Educational action research*, *16*(1), 55 – 72.

Beijaard, D. (1995). Teachers' prior experiences and actual perceptions of professional identity. *Teachers and teaching: theory and practice*, *1*(2), 281- 294.

Belhajjame, K., Zhao, J., Garijo, D., Hettne, K., Palma, R., Corcho, Ó., ... & Goble, C. (2014). *The research object suite of ontologies: Sharing and exchanging research data and methods on the open web*.

Best Survey Software Reviews and Comparisons (2015). http://survey-software-review.toptenreviews.com/

Birnbaum, M. H., & Reips, U. D. (2005). *Behavioral research and data collection via the Internet.* In: Vu, K. P. L., & Proctor, R. W. (Eds.) The handbook of human factors in Web design, pp. 471-492. Boca Raton, FL: CRC Press.

Bosnjak, M. (2012, November). *´No response is also a response´*. Interpretations for and implications of (non)response in self-administered surveys. Invited talk given at the 6th Tivian Symposium, November 9, 2012, Cologne, Germany.

Broekkamp, H., & van Hout-Wolters, B. H. A. M. (2007). The gap between educational research and practice: A literature review, symposium, and questionnaire. *Educational Research and Evaluation*, *13*(3), 203-220.

Chatzinotas S. and Sampson D. (2004). *eMAP: Design and Implementation of Educational Metadata Application Profiles*. In Proc. of the 4th IEEE International Conference on Advanced Learning Technologies ICALT 2004, Joensuu, Finland.

CoreIdeas (2014): http://www.cirtl.net/CoreIdeas/teaching_as_research.

Duval, E. (2001). *Standardized Metadata for Education: A Status Report*. http://files.eric.ed.gov/fulltext/ED466155.pdf.

Feldman, A. (2007). Validity and quality in action research. *Educational Action Research*, *15*(1), 21 – 32.

Fraser, B. J. (2012). Classroom learning environments:

Retrospect, context and prospect. In: *Second international handbook of science education* (pp. 1191-1239). Springer Netherlands.

Furlan, R., & Martone, D. (2012). Web surveys. *Statistics in Practice*, 89.

Gitlin, A., Barlow, L., Burbank, M. D., Kauchak, D., & Stevens, T. (1999). Pre-service teachers' thinking on research: Implications for inquiry oriented teacher education. *Teaching and Teacher Education*, *15*(7), 753–770.

Goble, C., De Roure, D., & Bechhofer, S. (2013). Accelerating scientists' knowledge turns. In *Knowledge Discovery, Knowledge Engineering and Knowledge Management (pp. 3-25)*. Springer Berlin Heidelberg.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational Design Research* (pp. 19-51). London: Routledge.

Gunn, H. (2014). *Web-based Surveys: Changing the Survey Process*. Retrieved from First Monday http://journals.uic.edu/ojs/index.php/fm/article/view/1014/935.

Harnad, S., & Brody, T. (2004). Comparing the impact of open access (OA) vs. non-OA articles in the same journals. *D-lib Magazine*, 10(6).

Hunter, J. (2006). Scientific Publication Packages - A selective approach to the communication and archival of scientific output, *The International Journal of Digital Curation*, *autumn* 2006.

Imans J. (red.). (2014). Krachtig meesterschap: Een op leren gerichte werkomgeving voor leraren in de school. [Research oriented school culture]. Script! Onderwijsonderzoek nr.1.

Kleinginna Jr, P. R., & Kleinginna, A. M. (1981). A categorized list of emotion definitions, with suggestions for a consensual definition. *Motivation and emotion*, 5(4), 345-379.

Shagoury, R., & Power, B. M. (2012). Living the questions: A guide for teacher-researchers. Stenhouse Publishers.

Sinnema, C. Sewell, A., & Milligan, A. (2011). Evidence-informed collaborative inquiry for improving teaching and learning. *Asia-Pacific Journal of Teacher Education*, *39*(3), 247-261.

Taconis, R., Jong, Ch. de & Bolhuis, S.M (2007). *CORF®: an internet platform for supporting student teachers in learning by inquiring teaching practices.* In B. Csapo & C. Csikos (Eds.), Developing potentials for learning: 12th EARLI conference, 28 August- 1th September 2007, Budapest, (pp. 457-458). Budapest.

Taconis, R., de Jong, C., Kools, Q., & Bolhuis, S. (2014). *CORF®: Internet ondersteuning voor (aankomend) docenten die praktijkonderzoek willen doen.* Internal publication Eindhoven School of Education.

Trochim, W., & Donnelly, J. (2006). The Research Knowledge Methods Base. Atomic Dog.

Vrijnsen - de Corte, M.C.W., Brok, P.J. den, Kamp, M.J.A. & Bergen, T.C.M. (2013). Teacher research in Dutch professional development schools: perceptions of the actual and preferred situation in terms of the context, process and outcomes of research. *European Journal of Teacher Education*, 36(1), 3-23.

Wubbels, T., Brekelmans, M., den Brok, P., & van Tartwijk, J. (2006). An interpersonal perspective on classroom management in secondary classrooms in the Netherlands. *Handbook of classroom management: Research, practice, and contemporary issues*, 1161-1191.

Yigit, T., & Ince, M. (2014). A Framework for Web-Based Learning Object Repository in Computer Engineering Education. Anthropologist, 17(3), 883-893.

Zhang, Y. (2000). Using the Internet for survey research: A case study. *Journal of the American Society for Information Science*, 51(1), 57–68.