Facing the heterogeneity of publication practices in transdisciplinary research fields. Altmetrical coverage in Educational Research.

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Introduction

Transdisciplinary research, for example in Climate Change Studies, Environmental Studies, and Educational Research has become a major topic in research as well as in science policy agendas, yet it has not been broadly established so far. It is characterized as a critical and reflexive research approach, which integrates societal problems into scientific issues, involves heterogeneous scientific and extra-scientific insights and contributes to both societal and scientific progress (Jahn et al. 2012; Nowotny et al. 2001; Gibbons et al. 1994).

Recently, major potentials of altmetrics have been identified in this context by involving the societal or extra-scientific area, and they are discussed as a broader view to scientific impact (Bornmann 2015, 2014; Barnes 2015). Furthermore, concerning the heterogeneity of transdisciplinary research fields, the potential of altmetrics to integrate a broader range of research products into the scientific evaluation apparatus like datasets, software, algorithms, grey literature, and slides is emphasized (Bornmann 2014; Zahedi et al., 2014a, Priem 2014). On the other hand, a series of problems have been articulated in altmetrics ranging from coverage, consistency and traceability of data sources and aggregators (Chamberlain 2013; Zahedi et al. 2015, 2014b) to the dependency on communication and publication practices of different scientific communities (Costas et al. 2014; Peters et al. 2014; Zahedi et al. 2014a).

In this paper, challenges of altmetrics regarding coverage of transdisciplinary research fields with heterogeneous publication practices are focused. Instead of following singular publications or singular serial publication sources, the coverage of a transdisciplinary research field is analyzed in detail. Educational research is chosen as a case study, which is characterized as problem-oriented, disciplinarily heterogeneous (e.g. psychology, social and political sciences, economics, computational sciences) with a strong alignment to educational practices.

In information and bibliometric studies, the heterogeneity of publication cultures and practices in social science and humanities (SSH) has already been addressed in general (Fry, Talja 2004; Nederhof 2006) and in particular in the transdisciplinary field of Educational Research (Dees 2008), where authors publish alongside in journals mainly in monographs and compilations. Thus, these research communities are misrepresented in citation and reference databases like Web of Science (WOS) and Scopus that are used as a base of comparison for altmetrics. Nevertheless, based on these restrictions, Mendeley readers data (39%) are found for WOS articles of “Educational Research” (Mohammadi, Thelwall 2014), and publications from an Educational Research institute (Leibniz Association) got around 30% of altmetrical data (Peters et al. 2014). Because of the transdisciplinary
character of Educational Research and its heterogeneous disciplinary publication cultures and practices, this study explores the specifics of the field in Germany and its coverage by altmetrical data. For a comprehensive view of the field of “Educational Research”, three different levels of altmetrical data coverages are addressed: 1) the individual coverage level of eight leading researchers, 2) the field coverage level of Educational Research and 3) the journal coverage level of major Educational Research journals.

Data & Methodology
The survey on the coverage of publication practices in Educational Research was carried out in subject-specific databases that as far as possible portray the disciplinary heterogeneity. For the field coverage level of publications (as of June 2016) in “Educational Research”, the German Education Index (GEI)\(^1\) was used (2010 – 2015), which offers a broad spectrum of different publication types (e.g. monographs) including grey literature and practice relevant publications outside of citation-based scientific ranking systems. To validate the coverage of the GEI and to address the individual coverage level for altmetrics, the publication outputs of eight leading researchers who work at four Educational Research institutes in the Leibniz Association\(^2\), were collected from different databases (GEI, WOS, Mendeley, ResearchGate). The bibliographic data has been aggregated, matched and compared. To access the researcher’s publication the GEI offers a person index to identify authors and ResearchGate has unique profiles. In Mendeley’s advanced search and the WOS Author Search a range of different name forms have been used. To determine the altmetrics coverage of major Educational Research journals (journal coverage level), articles were collected (January 2016) based on the index of editing characteristics of Educational Research journals (DEPOT\(^3\)). All ISSNs of the journals indexed in DEPOT were inserted in Altmetric.com via the Altmetric.com explorer to retrieve all articles indexed in the Altmetric.com database. The altmetrics for publications were retrieved via the Altmetric.com-API using R and the package rAltmetric.

Results
In order to address the coverage of Educational Research on an individual level (1), the publication outputs of eight leading German educational researchers were collected. Figure 1 describes the variations of this individual coverage level in relation to the different databases WOS, ResearchGate, Mendeley and GEI. While WOS comprises the most publications of just one researcher and ResearchGate of two, the GEI covers most publications in this group (n=5).

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1. [http://www.fachportal-paedagogik.de/fis_bildung/fis_form_e.html](http://www.fachportal-paedagogik.de/fis_bildung/fis_form_e.html)
   For limitations see (Dees 2008).
On this basis, 622 publications of these researchers with DOIs (n=622) were collected (Table 1), 16.9% of these displaying Altmetrics. Mendeley accounted for most of the DOI publications with 16.1% followed by Twitter at 11%. Facebook (3.4%), News (0.8%), Wikipedia (0.8%), Google+ (0.8%) and Blogs (0.6%) remain in the lower part of a single decade.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Publications with DOI</th>
<th>Publications with DOI</th>
<th>Twitter</th>
<th>Facebook</th>
<th>Mendeley</th>
<th>Blogs</th>
<th>News</th>
<th>Google+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher1</td>
<td>174</td>
<td>2,386</td>
<td>16 (9.2%)</td>
<td>9 (5.2%)</td>
<td>22 (12.6%)</td>
<td>1 (0.6%)</td>
<td>0</td>
<td>2 (1.1%)</td>
</tr>
<tr>
<td>Researcher2</td>
<td>14</td>
<td>2,657</td>
<td>1 (7.1%)</td>
<td>0</td>
<td>1 (7.1%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Researcher3</td>
<td>87</td>
<td>3,341</td>
<td>10 (11.5%)</td>
<td>1 (1.1%)</td>
<td>10 (11.5%)</td>
<td>1 (1.1%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Researcher4</td>
<td>137</td>
<td>3,029</td>
<td>13 (9.5%)</td>
<td>4 (2.9%)</td>
<td>24 (17.5%)</td>
<td>0</td>
<td>0</td>
<td>2 (1.5%)</td>
</tr>
<tr>
<td>Researcher5</td>
<td>176</td>
<td>2,850</td>
<td>27 (15.3%)</td>
<td>6 (3.4%)</td>
<td>48 (27.3%)</td>
<td>2 (1.1%)</td>
<td>5</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Researcher6</td>
<td>48</td>
<td>1,813</td>
<td>2 (4.2%)</td>
<td>0</td>
<td>3 (6.3%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Researcher7</td>
<td>18</td>
<td>16,076</td>
<td>1 (5.6%)</td>
<td>0</td>
<td>1 (5.6%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Researcher8</td>
<td>7</td>
<td>2</td>
<td>2 (28.6%)</td>
<td>2 (28.6%)</td>
<td>1 (14.3%)</td>
<td>0</td>
<td>0</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>All</td>
<td>622</td>
<td></td>
<td>68 (11%)</td>
<td>21 (3.4%)</td>
<td>100 (16.1%)</td>
<td>4 (0.6%)</td>
<td>5</td>
<td>5 (0.8%)</td>
</tr>
</tbody>
</table>

Table 1: Altmetrics of eight leading educational researchers (individual coverage level)

The field coverage level (2) of Educational Research publications based on the German Education Index (2010 - 2015) reveals that 21.2% of the publications with DOI have altmetrical data. 19.5% of these publications with DOI were mentioned at Mendeley, followed by Twitter (17.5%), Blogs (2.3%), Google+ (1.0%) News (0.2%). By taking into account the restrictions of the needed identifier DOI, a profound limitation becomes apparent: 12% of the collected publication output have a DOI (16,076 out of 134,301) and could be mapped with Altmetrics. Concerning the full range of collected publications (2010 - 2015) and the circumstances of aggregation, just 2.5% (n=3,404) could be identified and connected to altmetrical data.

\[5,171 \text{ of all publications have the identifier URN (3.6%), which Altmetrics.com just recently started to collect.}\]
Table 2: Altmetrics for the publications in the German Education Index (field coverage level)

Analyzing the noise, a more precise picture emerges when considering the different types of publication used in a transdisciplinary research field and its heterogeneous publication practices. Figure 2 describes the distribution of publication types in relation to the entire publication output in “Educational Research”, based on the GEI (2010 - 2015), the shifts through the restrictions of the identifier DOI and the coverage of altmetrical data. The increasing predominance of journal articles from 48% of all publications to 60% of the publications with DOI and to 82% of the publications with altmetrical data is obvious. Other major publication types in the field like monographs and parts of compilations (Dees 2008) decrease from 52% (all) to 40% (with DOI) to 18% (Altmetrics). Taking into account that different research communities in transdisciplinary fields follow different publication practices, it seems possible that parts of the field of Educational Research face disadvantages whereas others are promoted.

Figure 2: Proportion of publication types (field coverage level) in the German Education Index (2010 – 2015)

While the impact on society is seen as a great potential for Altmetrics (Bornmann 2015, 2014), the relevance of its output and the addressed target group also play a central role in a transdisciplinary field like Educational Research. In this regard, the language of a publication affects capacities for participation. Following the changes of distribution of all publications recorded in the GEI (2010 - 2015) in comparison with the publications with DOIs and the coverage of altmetrical data, a similar shift as the one for the publication types is evident: While publications in German are at 72% in the GEI corpus and thus predominant, publication output with DOI is only 43%, and 5% are covered with
altmetrical data (Figure 3). Given these conditions, it would seem problematic to address a language-specific target group, and expectations of altmetrical research output are currently limited.

The index of editing characteristics of Educational Research journals DEPOT (as of February 2016) describes and qualifies 310 journals, which builds a solid base for analyzing the coverage of Educational Research altmetrics on a journal level (journal coverage level (3)). A query of ISSNs revealed that 1,952 articles have altmetrical data, encompassing 27 journals, i.e. 8.7% of all DEPOT journals. Reduced to the years 2010 – 2015, 1,431 articles of 27 journals have altmetrical data, as described in Table 3.

21 of these journals have less than 50 articles with Altmetric mentions covered by Altmetric.com and 12 journals have less than 10 mentioned articles. Considering the previously described language variety only one of the six journals with more than 50 articles with Altmetric mentions is a German speaking journal. Figure 4 shows the same rising tendency in Almteric-numbers as found for the Articles in the GEI and similar studies.

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5 Due to the data collection method, direct via ISSN from Altmetric.com, it is not possible to have an overview over all publications in DEPOT-journals or the publications with DOI. The output was a list of all articles with Altmetric-mentions.
Taking into account that journal articles are one of the major publication types in Educational Research (see field level coverage), the impact of the described limitations should be seen as more evident.

**Discussion**

In this study, we explored the coverage of altmetrics with respect to heterogeneous publication practices and outputs in a transdisciplinary field, namely “Educational Research”. While altmetrics offers the potential to transnationally address a broader scope of scientific outputs, the study focuses on classical publication outputs and analyses the coverage of altmetrical data. The heterogeneity of publication practices in relation to aspects of affordances of a transdisciplinary research field is studied, whereby the coverage of altmetrics on an individual level of researchers, a field level, and a journal level is realized. Taking into account the broad publication output of a research field and the restrictions of identifier, the coverage of altmetrical data needs to be recontextualised. Instead of high percentages (39%) like at WOS articles matchings with Mendeley readers data (Mohammadi, Thelwall 2014) or 30% of altmetrical data for articles of an Educational Research institute (Peters et al. 2014), just 2.5% of all publications in the German Education Index (2010-2015) have measurable altmetrical data. Additionally, it is evident that the heterogeneity of publication practices is decreasing while journal articles and English language publications are predominant. The perspective to the coverage of a research field shows that already the classical research output in terms of publications entails profound shifts, which problematizes fundamentally the usage of Altmetrics for scientific evaluations. Nevertheless, the study shows as well that social media are used for communicating scientific publications in a social sciences and humanities context. While altmetrics is currently little used in Educational Research, a range of circumstances give reason to anticipate positive developments in the use of Altmetrics, for monitoring research fields, trend identification, enrichment of research outputs, or a stronger participation of the extra-scientific world. The use of identifiers is increasing, Altmetric aggregators like Altmetrics.com involve further identifiers like the URN and short messages are more and more established on international conferences and in Educational Research.

**References**


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6 All URLs tested on 14th September 2016


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