DOI: 10.1515/jtes-2015-0009

Journal of Teacher Education for Sustainability,
vol. 17, no. 2, pp. 5–43, 2015

Developing Research in Teacher Education for Sustainability: UN DESD via the *Journal of Teacher Education for Sustainability*

Anita Pipere
Daugavpils University, Latvia

Marika Veisson
Tallinn University, Estonia

Ilga Salīte
Daugavpils University, Latvia

Abstract

This study marks the end of the UN Decade of Education for Sustainable Development that coincides with the 10th anniversary of the Baltic and Black Sea Circle Consortium on Educational Research (BBCC), and aims to analyse the research output performance of BBCC members and other scholars published in the *Journal of Teacher Education for Sustainability* (JTEFS) during this last decade. Using the methodology of bibliometric study and literature review, the authors describe the main bibliographic indicators of JTEFS and provide a qualitative and quantitative analysis of the research paradigms and their developmental changes in the papers published by JTEFS (2005–2014). The results of the study show that in general the journal has evolved in line with the advanced trends in educational research, research in teacher education, research in sustainability education and sustainability studies in higher education. The analysis of published papers indicates both the progress and issues of research in teacher education for sustainability. The authors conclude with some visionary insights into the further development of JTEFS and this research field in general.

Keywords: JTEFS, teacher education, sustainability, research paradigm, bibliometrics

To achieve its goals, research in any discipline needs to be disseminated both locally and globally, and for novel fields of study, the establishment of academic periodicals designates a certain maturity and illustrates striving towards academic quality and recognition. This extensive paper is the first attempt to focus on research in the field of teacher education (TE) for sustainability through the publications of the *Journal of Teacher Education for Sustainability* from 2005 to 2014. This period coincides with the UN Decade of Education for Sustainable Development (DESD); therefore, framing the research development in TE in line with local and global needs and contexts.

Zooming Out and In: The Contemporary Contexts of JTEFS

In order to ensure a full-fledged overview of JTEFS, a short review embedding the establishment and growth of JTEFS in its specific historical and geographical context would be appropriate. The origins of JTEFS are connected with several international developments and local events that will render a more profound understanding of this academic phenomenon.

At the end of the 20th and beginning of the 21st century, Latvia can be characterized as a small developing country in the Baltic region, situated at the crossroads of northern and eastern Europe. At that time, Latvia had recently regained its independence and was striving to change all spheres of social, economic and political life including education. Reorganisation, change and rapid development also became habitual features in higher education institutions and TE in particular.

Daugavpils is the second largest city in Latvia, and is the location of one of the country's few state universities – Daugavpils University (DU) – which is still a very small university if we compare with the average size of universities in larger European countries. Since its establishment in 1996, the majority of the activities performed by the Faculty of Pedagogy and Psychology at DU has been oriented towards the development of TE and training. In 2000, the faculty joined the international network of Teacher Education Institutions associated with the UNESCO Chair on Reorienting Teacher Education to Address Sustainability at York University in Toronto, Canada, led by Charles Hopkins. Considering the research potential of the faculty, it was suggested that one of its activities in this network could be the publication of a new international journal for the dissemination and appropriation of experience gained at the university and through international cooperation. The intention was to demonstrate a contemporary focus and the proposal of solutions to problems in TE in Latvia as well as theoretical and practical approaches to TE for sustainable development (SD) in other countries. Consequently, in 2002, the first issue of *Journal of Teacher Education and Training* (since 2007 – *Journal of Teacher Education for Sustainability*) was published as the first international peer-reviewed journal in the sphere of education in Latvia at that time. In order to invigorate and extend the cooperation of TE institutions in northern and eastern Europe aiming to integrate sustainability in their educational discourse, in 2003, the 1st International JTET Conference "Sustainable Development. Culture. Education" was held at DU. In the same year, the Institute of Sustainable Education (ISE), chaired by Professor Ilga Salīte, was established at the faculty.

It is no coincidence that simultaneously with the launch of the UN DESD, the Baltic and Black Sea Circle Consortium (BBCC) was established in 2005 on the initiative of ISE. By its 10th anniversary, the BBCC is an international network that unites the efforts of researchers and practitioners from more than 20 countries in the field of TE for sustainability. BBCC was originally created on the basis of the cooperative network of the *Journal of Teacher Education and Training*. The regular meeting place for BBCC members throughout these years has been the annual international conference "Sustainable Development. Culture. Education" hosted since 2003 by a different consortium member state each year. The conferences offer the opportunity for researchers and teachers to join a 'family' of like-minded enthusiasts and get involved in collaborative research and international networking; they have also served as leverage to maintain the editorial and submission process of the JTEFS.

As outlined in the journal's guidelines, JTEFS is a forum for the meeting of different views, ideas and research to promote the further development of studies and practices in TE in all areas of formal and non-formal education in relation to sustainability. Its policy aims to encourage the submission of articles relevant to the content and form of teacher professional and academic education, the problems and tasks of teacher in-service education and other issues that help teachers become responsible mentors for sustainable development. It is the only journal in the world targeting TE in connection with sustainability. In communication with potential authors the Editorial board at JTEFS has always emphasized the need to respond to the demands of different global movements toward sustainability in education, starting with the network already mentioned by the UNESCO Chair at York University, but also helping to implement the *UNESCO Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability* (UNESCO, 2005) and monitoring the success of UN DESD in the field of teacher education.

This paper is not the first attempt to reflect on JTEFS as a meeting place for researchers in TE for sustainability. In 2005, a short vignette about the journal was included in the *UNESCO Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability (2005)*, stressing the main historical milestones the journal has attained. In 2007, professors Ilga Salīte and Anita Pipere were invited to outline the history of the journal and present its context in the UNESCO publication, *Good Practices in Education for Sustainable Development: Teacher Education Institutions* (Salīte & Pipere, 2007). In this publication, the innovative aspects, effects, results and impact of JTEFS were described for the first time. In terms of success factors, it highlighted

> ...the network of universities emerged using the "snowball" approach within the JTET Conferences. We also sought to identify selfless, devoted, and committed scholars interested in teacher education, education for sustainable development, and sustainable development. The international team of the editorial board for many years has been extraordinarily responsive and has provided outstanding support for this project. Cooperation among universities and scholars has been maintained continuously over the years. (Salīte & Pipere, 2007, p. 44)

At the end of the chapter, the authors put forward some future initiatives to ensure the viability and momentum of the project including several tasks: 1) to establish the journal as an indexed peer-reviewed publication, included in major publication databases, 2) reorient the content of JTET articles more clearly toward topics of TE, sustainable development, and education for sustainable development, 3) increase the number of contributions from doctoral students. The current paper, among the other things, will illustrate the level of the present attainment of the goals set for the journal in 2007.

The paper is structured as follows. The next section envisions the research in TE for sustainability, embedding this specific field of inquiry in more general areas of educational research, TE research, education for sustainable development (ESD) research and research in higher education (HE) for sustainability; therefore, setting up the criteria for the further empirical analysis of JTEFS articles. The section Researching the research, details the methodological underpinnings of the study, while the Results section highlights the main bibliometric indicators, describes the research paradigms and their developmental dynamics within JTEFS (2005–2014). The final chapter summarizes, interprets and puts the main contributions of this study in perspective.

Research in Teacher Education for Sustainability: Building up the Field

To provide an insight into the research in the field of TE for sustainability over the last decade is not an easy task due to almost non-existent reviews on this specific topic and the scarcity of overviews on more general topics related to this discourse. To manage this task, we will attempt to nest the TE research in the more general field of educational research, as well as to scrutinize the research on ESD and sustainability. Furthermore, as a bridge between the educational/TE research and ESD research, research in HE for sustainability will be analysed since TE can be viewed as unequivocally embedded in the context of HE. At the end of the chapter we will briefly summarize and integrate all the research areas mentioned above for the research topic of TE for sustainability. To link the mentioned subject matter with the journal discourse, the research outlines will be correspondingly connected to the issue of knowledge dissemination in academic publications.

Educational Research

The American Educational Research Association (AERA) currently defines educational research as a

> scientific field of study that examines education and learning processes and the human attributes, interactions, organisations, and institutions that shape educational outcomes. Scholarship in the field seeks to describe, understand, and explain how learning takes place throughout a person's life and how formal and informal contexts of education affect all forms of learning. Education research embraces the full spectrum of rigorous methods appropriate to the questions being asked and also drives the development of new tools and methods. (AERA, 2015)

Educational research, as a domain of academic inquiry, is a relatively young field; hence, several issues relating to research activities and approaches are still under negotiation. For instance, one such point of discussion pertains to the relationships between empirical and theoretical research. Although educational research published in top journals contains not only empirical research but also policy analysis, discussion papers, meta-level research and so on, currently it seems that the academic community of educational research values empirical research higher than theoretical work, since the natural sciences has already been used as the model for several decades (Standish, 2007). Though, some scholars admit that educational research that is based on the empirical traditions of the social sciences should be distinguished from different forms of research grounded in the humanities, theoretical, conceptual or methodological essays, and critiques of research traditions and practices (Smeyers, 2008). Therefore, the roots of natural and social sciences and humanities can all be traced in current educational research, albeit in different proportions depending on the context.

In terms of methodology, the contextualisation of theoretical insights is necessary for educational research, since many doubt if one can establish universal laws in the social sciences. Nevertheless, the majority of research in this field still uses quantitative methods, although the importance of qualitative studies has accrued at a significant rate. Notwithstanding, present-day educational research is related to positivist, post-

positivist and postmodernist paradigms that envisage both empirical and theoretical research and the blend of quantitative, qualitative and mixed methods.

The AERA panel recommendations, provided in 2006, in some instances, can be used as a valuable tool in order to analyse the research paradigms encountered within a journal on educational research, although, several critical voices were heard afterwards (Howe, 2009; Smeyers, 2007) in regard to excessive empathy with the positivist research paradigm. AERA calls for consistent terminology, a full description of data collection and analysis methods together with the research context, a relevant theoretical framework, connection between TE and students' learning, multi-disciplinary and multi-methodological approaches, more in-depth multi-institutional case studies of TE programs and their components, etc. (see Zeichner, 2005).

The authors of this paper tend to agree with Smeyers (2008), who proposes the idea to resign from several traditional dichotomies such as values/facts, objective/engaged, researcher/practitioner, concept/fact and qualitative/quantitative/interpretive while engaging in educational research. According to Shulman (1997), educational researchers should not ensue some particular method, they must first understand the problem and decide what questions they are asking then select the mode of disciplined inquiry most appropriate to those questions.

The volume of this paper does not permit the full scope of contemporary methodologies and theories used by researchers in educational studies to be analysed; therefore, we will briefly sketch only two examples of novel research approaches – design-based research and complexity theory that could be successfully applied in the field of educational research.

Design-based research is oriented to the problems of practice and can help create usable knowledge about developing, enacting and sustaining innovative learning environments (DBRC, 2003). Such research takes place through continuous cycles of design, enactment, analysis and redesign (Cobb, 2001; Collins, 1992), and it must account for how designs function in authentic settings and lead to sharable theories that help communicate relevant implications for practitioners and other educational designers (cf. Brophy, 2002).

One of the recent theoretical approaches that can be advisedly used in the field of educational research is complexity theory. However, the theory of holism as a predecessor of complexity theory in educational research has already reaped the fruits of unconventionality for a couple of decades. Although it is an eclectic and inclusive approach to education, in its core it aims to nurture wholeness in all aspects of traditionally segmented and compartmentalized educational discourse like individual development, relationships between the individual and the world, disciplines of knowledge, educational aims and so on. The holistic approach to education, based on the principles of interdependence and connectedness, also focuses on the meaning-making aspects of education and stands against the materialistic, consumerist and spirit-denigrating culture (Mahmoudi, Jafari, Nasrabadi, & Liaghatdar, 2012). In terms of research methodology in social sciences, methodological holism suggests that "social relations can only be interpreted and explained in terms of social wholes" (Mittelstrass, 2014, p. 8). Some authors consider the concept of emergence as the theoretical link between holism and complexity (for a more extensive explanation, see Agazzi & Montecucco, 2002; Law & Mol, 2002; Mittelstrass, 2014). However, literature studies show that complexity theory has probably gained larger popularity in the natural sciences than in social disciplines.

Several qualities featuring complexity like self-organisation, self-maintenance, and the tendency to be nested within other systems might be applied to many phenomena characteristic of education; for example, individual sense-making, teacher-learner relationships, classroom dynamics, school organisations, community involvement in education, bodies of knowledge, and culture (Davis & Sumara, 2008). Further, some strategies of complexity theory can be relevant to phenomena within educational discourse. One describes the "level jump" expedient to understanding the transphenomena prevailing in education – the researcher focuses on the phenomenon, its particular coherence and behaviour, and, at the same time, examines the context and conditions of its emergence. Another two strategies relate to transdisciplinarity and interdiscursivity – the integration of different discourses usually applied in segregated contexts.

The authors agree with Davis and Sumara (2008) that education and educational research conceived in terms of expanding the space of the possible rather than perpetuating entrenched habits of interpretation, then, must be principally concerned with ensuring the conditions for the emergence of the as-yet unimagined or the currently unimaginable. An education in terms of complexity cannot be conceived as a preparation for the future, rather it must be construed in terms of participation in the creation of possible futures. Complexity theory stresses the networks, linkages, holism, feedback, relationships and interactivity in context (Cohen & Stewart, 1995), emergence, dynamic systems, self-organisation and open systems (rather than the closed world of the experimental laboratory) (Davis & Sumara, 2008) that could also be applied within sustainability science. However, we should be cautious since complexity theory can suggest what to do if one wishes to promote development, but it does not tell us if those actions are desirable. One should also deliberate whether bringing complexity theory into education while avoiding matters of a moral nature is acceptable and does not turn into some form of scientism (Davis & Sumara, 2008).

Teacher Education Research

There is substantial evidence (both empirical and philosophical) that research has a major contribution to make to effective TE in different ways (BERA, 2014). Further, there is a growing demand both for research about teaching and TE and research "consumed" by teachers and teacher educators (Erixon & Gun-Marie–Kallós, 2001). Research can make a positive contribution to each aspect of teacher professional knowledge: practical wisdom, technical knowledge and critical reflection (Winch, Orchard, & Oancea, 2014).

Borko et al. (2007) have discerned four genres of TE research that will be used in this paper to classify research reports published in JTEFS. The first genre, "effects of TE research", is based on the positivist paradigm of natural sciences and can be related to quantitative inquiry. Such research attempts to reveal the general patterns of relationships between student teachers, TE practice and programmes, and the learning of student teachers and school students using research methods like experiments, quasi-experiments and correlational research. The research on the effects of TE research can be helpful in designing and evaluating TE programmes. However, the generalizability of effects in TE is not always useful because of the contextual and local nature of teaching and learning (Borko, Liston, & Whitcomb, 2007).

The second genre, "interpretive research", holds the features of qualitative inquiry aiming to grasp the local meanings. The specific situation is illustrated in its wholeness from the perspectives of participants. Such research provides a detailed interpretation of local variations of settings, actions and sense-making of contexts and activities. This research aims to improve practice, illustrate success and issues of policy enactment and shape theoretical development. Interpretive research tries to comprehend the socio-cultural processes in natural settings related to TE. The data collection and analysis methods for this genre are in tune with that of qualitative research. Interpretive research has contributed to our understanding of TE courses and field experience, the work of teacher educators and the essence of valuable TE programmes as well as the impact of such work and programmes on the professional development of student teachers (Borko et al., 2007).

The third research genre, "participant research", can essentially be viewed as part of qualitative or interpretive research. It features the specific role of the researcher and the purpose of the research: the research is conducted by those who do the work of TE in order to understand and improve practice within a local context; therefore, blurring the boundaries between research, practice and improving the practice of TE. This type of research includes action research, participatory research, self-study and teacher research. Such studies should be adequately reported following all the requirements for high quality research articles, since in this way such research serves not only the purpose of improving the researcher's practice but also increasing the possibility of using studies by professional peers.

The last and most recent research genre in TE is design research, already mentioned above. It allows close links between practice improvement and theory development. In the area of TE, a research team might design and enact an educational environment for future teachers and explore their development in this environment. The idea of such research is not the creation of generalizable and replicable educational programmes, but rather the adjustment of the TE process in tune with the continuous assessment of individual and collective activity (Borko et al., 2007).

Research in TE has been criticized for its inconsistent quality and inability to respond to the most urgent problems of the field, although, as with educational research, it is a relatively new field of study. Rigorous, large-scale research on TE is difficult, time-consuming and expensive to conduct; therefore, some of the theoretical and methodological advances seen in more mature fields are just beginning to emerge in research on TE. Currently, TE research consists mainly of smaller-scale studies using interpretive and participant research, typically carried out by teacher educators individually and collectively, or in collaboration with schools or student teachers. The reviews conducted both in the US and UK attest to the scarcity of larger-scale studies providing system-wide and policy-oriented research evidence, and the notable lack of studies performing a full inspection of the various aspects of TE (BERA, 2014; Tatto, 2013). However, while interpretive and participant research is not quite relevant to respond to the current policy challenges in TE, they have convincingly proved the complexity of the TE area.

To conclude, for TE research to influence the "crafting of wise policy, the improvement of practice, and the development of theory, we must ensure that it draws from multiple disciplines, is pluralistic in its methods, and is rigorously conducted and reported" (Borko et al., 2007, p.16). One of the most important contributions JTEFS can make is to help push the field forward – to improve the quality and impact of TE research.

Research in ESD/Sustainability Education

The research in ESD/sustainability education is a field of study that is also not fully established and even not sufficiently discussed among scholars, although the last decade shows a movement toward more complex forms of research activities (Tilbury, 2011). With the apparent aim of helping countries establish local ESD research, UNESCO (2012) recently created the *Guidelines for Creating a National ESD Research Agenda and Plan* where ESD research is viewed as a sub-field of educational research or research related to education, public awareness and training, and is conducted in formal, non-formal and informal educational settings. Invited experts have discerned nine themes as central to ESD research; for example, tracking the progress of the DESD, conceptual analysis of ESD, the contribution of ESD to the sustainability of society and the educational community, efforts to support or hinder ESD. These themes can be performed via the four tenets of ESD, namely: improving access to and retention in quality basic education, reorienting existing educational programmes to address sustainability, increasing public understanding and awareness of sustainability and providing training (UNESCO, 2012). However, it should be observed that nations practising ESD differ greatly in their institutional settings, which are in turn embedded in wider socio-cultural processes. The ESD research conducted in countries with pronouncedly distinct cultural and historical backgrounds could also bear the specific features that enrich the global concept and understanding of ESD and sustainability.

The current topics in ESD research identified by the survey of researchers from different countries mostly align with those discerned by UNESCO. The majority agree that ESD research should be aimed at examining the current situation in the field, developing models for personal and societal life in the future, changing human awareness and actions toward more sustainable lifestyles and responsibility toward the rest of the world. Some researchers have prioritized a new vision of education (awareness, self-regulation, world views, etc.), recognized the need for the evaluation of ESD and the development of contextualised educational models (Pipere, Reunamo, & Jones, 2010).

In relation to the development of a distinctive methodology for ESD, scholars still probe for relevant approaches, trying to adapt and design research instruments (Reunamo & Pipere, 2011). The Reunamo model of agentive perspective (Reunamo & Pipere, 2011) has been adapted for ESD research to evaluate the research in terms of four orientations that dovetail the descriptions and classifications of educational and TE research provided above. In the qualitative research orientation (adaptive and accommodative research), the researcher is interested in the phenomenon as an experience of something real and seeks to adapt to it. Embarking on quantitative inquiry (adaptive and assimilative research), the researcher applies predefined assumptions to an existing environment. In the theoretical research orientation (agentive and assimilative research), a theory is built or applied to describe the dynamics of the phenomenon in order to find ideas that contribute to environmental change; and in participative research orientation (agentive and accommodative research), the research itself is seen as a possible vehicle for environmental change (Reunamo & Pipere, 2011). Therefore, in ESD research, qualitative studies should be aimed at understanding the motifs and discourse of SD, quantitative research evidently will help to obtain a valid and generalized picture of SD and its mechanisms, theoretical research will try to create tools to connect the past and future, while participative inquiry will deepen the researchers' awareness of their role as producers of cultural content and

the ingredients of SD (Reunamo & Pipere, 2011). In the present article, these four orientations will be used to evaluate the research paradigms in JTEFS.

ESD/sustainability education research also has several issues to be considered aiming toward the development of this field. To start with, in order to perform a scientifically rigorous investigation in any field, one has to present the unitary research object that does not raise doubts for the majority of the researchers in the given field. Several authors point to the lack of unity in terms of conceptual and methodological issues in ESD research (Nolet, 2009; Kopnina & Meijers, 2014; Reunamo & Pipere, 2011, 2012; Stevenson, 2006; Wals, 2010). Besides, the very objectives of ESD need further critical reflection (Kopnina & Meijers, 2014). Several voices also warn that in the majority of ESD research, there is a habit of ignoring the deep ecological and indigenous perspectives (Anderson, 2012; Naess, 1973) and exhibiting an anthropocentric bias (Kopnina, 2012). To consider this implication in this paper, we will use the philosophical criteria of the classification of papers in terms of their anthropocentric/non-anthropocentric orientation (Thompson, 2000).

The other issue could be the urgent need for negotiation in terms of relationships between the concept and purpose of education and that of sustainability. Sund and Lysgaard (2013) express caution about the risk of focusing on societal outcomes and changing public behaviour rather than on educational processes. One should ask if ESD really promotes the acquisition of knowledge and understanding, and supports the development of independent thought or mainly stresses the aim of behaviour modification through education. In trying to change practice and ways of life, one should not forget the moral aspects of teaching and learning. Sund and Lysgaard (2013) point to the importance highlighted by philosopher Hanna Arendt that any political use of education is just indoctrination, while the real purpose of education is to create a space for explorative actions. A normative education focusing on particular societal goals can be disadvantageous to the participating individuals and their personal abilities, action competences as well as the practice of more informed actions. However, giving more freedom to students, SD can be an interesting and challenging concept for discerning the different stakeholders' perspectives (Sund, 2015). ESD research can lose its connection to advanced educational research if it focuses primarily on quick fixes to social problems and fast life-style changes. Besides, in conducting ESD research, one needs to have a deep understanding of educational philosophy and the theories of education to make explicit educational and philosophical assumptions about ESD research. Furthermore, the major issue for journal editors has been the insufficient contextualisation of many manuscripts in the research area (Payne, 2009).

The more radical voices (Knutsson, 2013) suggest that academics should clearly see the boundary between empirical research and ideological indoctrination. The ideological assumptions to be included in the foundation of the empirical research of ESD need to be fully recognized, discussed and problematized so as not to conceal some important ideological tensions and contradictions. The question is: how aware are ESD researchers when they use ESD as a scientific concept or as a political instrument. It is important that ESD researchers explore not only the normative definition presented by UNESCO, but also how the multiple meanings of ESD unfold in educational practice (Öhman, 2011). Knutsson (2013) uses the term post-politics to describe the offering of sophisticated, technical and administrative solutions to 'problems' that are actually related to conflicts of interest and inequality. The research of ESD should not be turned

into a means to depoliticize societal conflicts through conceptual flexibility, responsibilization where the individual subject is expected to find individual solutions to structural problems and contradictions, and the redefinition of 'the political' in terms of individual morality, competence and resilience. One should not approach ESD as a liberal government technique that aims to produce responsible and resilient subjects, but rather as an opportunity to ensure the circumstances for the emergence of a sustainable future.

Research in Higher Education for Sustainability

The analysis of current trends in research in HE for sustainability through an international literature review of 110 journals from 1992–2012 (Barth & Rieckmann, 2013) shows a strong increase in publications since 2008 and the stabilisation at a high level since then. About half of the publications focus on curriculum development and teaching/learning approaches. Such topics as organisational change/learning, student and lecturer views, the development of sustainability in HE in different regions and the assessment of learning outcomes were represented less often. The thematic focus of this research field can also be shown through the analysis of articles published in the first ten volumes of the *Journal of Higher Education for Sustainability* (Wals & Blewit, 2010). Among the most popular topics were environmental management/campus greening (25% of articles), integrating sustainability in different disciplines (17%), and pedagogy, learning and instruction (17%). Such topics as theoretical concepts, community partnerships, organisational learning, curriculum, quality assurance and professional development were investigated less often.

In terms of research methodology, Barth and Rieckmann (2013) have identified that half of the analysed papers feature case studies (52%); conceptual papers are the next largest group (22.3%), then come surveys, longitudinal, cross-sectional and trend studies (11.5%). The papers from the journals analysed also contained methods such as naturalistic and ethnographic research, action research, historical and document research. The three most popular data collection tools were survey, document analysis and interview. The authors conclude that there are enough descriptive studies and that the field needs a larger number of exploratory and explanatory studies. Several authors have also admitted the lack of comparative studies contrasting policies and practices in multiple institutions in regard to sustainability initiatives and the implementation of sustainability (Corcoran, Walker, & Wals, 2004; Swearingen White, 2009; Vaughter, Wright, McKenzie, & Lidstone, 2013; Wright, 2002).

According to Tilbury (2011), the main trends observed in the last decade in research in HE for sustainability have been inter- and multi-disciplinary, transformative research with a social impact focusing on social and structural change, where the researcher is a partner and the research is conducted not on people but with people. The new wave of research challenging the dominant research paradigms and research practice critically reflects on the role of research in reproducing exploitative relationships with people and the environment. The researcher should be conscious and explicit about the power, politics and participatory relations underpinning research practice that handles critical questions. For example, among other questions: Who commissions the research and for the benefit of whom? Who can access the research and how? How is complexity embraced within the research? Is there congruence between the 'what' and the 'how' of the research?

One of the issues connected with this field is that most of the universities that engage in the issue of sustainability are universities that have a focus on education rather than on research. Strong research universities tend to pay less attention to both ESD and sustainability in general (Wals, 2013). Moreover, although the single projects in HE toward sustainability seem to be relatively easy to launch, attempts to mainstream the sustainability agenda across HE has so far failed to have any impact (Tilbury, 2011).

Research on Teacher Education for Sustainability

To summarize, the research on TE for sustainability therefore can be constructed and critically deconstructed grounded on the interplay of educational research, TE research, ESD/sustainability research and HE for sustainability research. The general features possessed by these both general and specific fields of research in terms of research paradigms, theoretical approaches, methodologies, topics and research issues can obviously be connected with the need to develop quality research in the field of TE for sustainability.

In a nutshell, research on TE for sustainability can include both empirical and theoretical studies since its disciplinary background can be traced in the natural sciences, the social sciences as well as the humanities. Such research should not try to find the single most appropriate method, but rather select the mode of inquiry relevant to the research problem and research questions; therefore, both qualitative, quantitative and mixed methods approaches are possible. The novel theoretical and methodological approaches (e.g., design research or complexity theory) should, however, be applied not as an end in itself but as an option for successfully dealing with the prevailing contradictions and challenges in the field of sustainability research. In terms of research genres, the research on the effects of TE research for sustainability, for instance, can be applied so as to create and assess the reorientation of TE programmes toward sustainability. Interpretative research would help to reveal the complexity and build a theory about different aspects of TE for sustainability in their contextual variations, attaining best and worst cases in terms of local meaning. Participant research, mainly in the form of action research, would provide the possibility to improve the local practice of TE oriented toward sustainability within a local context and contribute to the puzzle of the global context of TE for sustainability. In relation to design research, a research team of teacher educators, for example, would design and enact an educational environment for future teachers supporting the development of ESD competences and explore their development in this environment.

Research in TE for sustainability needs more multi-disciplinary and multi-methodological approaches, and profound multi-institutional studies. In addition, larger-scale comparative studies providing system-wide and policy-oriented evidence, although hard to conduct, would be necessary to develop the field. It is self-evident that to disseminate research in TE for sustainability in any genre and research paradigm, the report must be written in line with the requirements for rigorous scientific contributions, considering the requirements for structure, content, etc. Furthermore, the reviewers of articles on TE for sustainability have to consider and carefully deal with the diversity of research coming from different parts of the world caused by the distinct cultural and historical background and institutional discourse.

Researchers working in the field of TE for sustainability should carefully follow the latest events in terms of the conceptual development of ESD/sustainability, recent

discussions on educational theories and philosophical approaches in education, and try to overcome the anthropocentric bias, avoiding implicit attempts at political indoctrination and post-political thinking.

The analysis of JTEFS will show whether the published articles in terms of their research approach match the highest attainments and latest trends in the mentioned research fields, and also how the said issues have been dealt with.

Researching Research: A Methodological Explanation

This section of the paper advances the methodological explanation of the presented research focusing on the features of quantitative and qualitative bibliometric study and outlining certain similarities with the literature review method.

Bibliometrics involves a document-related process and, in general, provides the quantitative characterization of scientific activity (Regolini & Jannes-Ober, 2013; Wright & Pullen, 2007). Initially, the subject of bibliometrics was introduced by Pritchard (1969) as "the application of mathematical and statistical methods to books and other media" (p. 349); however, today we can also see several studies with markedly qualitative analysis in terms of research topics, philosophy and methodology under the title of bibliometric studies (Kevin, Zainab, & Anuar, 2009). Bibliometrics can be applied to many elements of scientific activities – single journals, groups of journals with a similar thematic orientation, websites, databases, scientific publications in a specific time slot from a single country and so on.

In our case, we will adapt the methodology of bibliometrics to the analysis of a single periodical in the emerging research field of TE for sustainability. According to Thanuskodi (2010), scientific periodicals serve as a primary source for recent research findings, new trends and current developments in any scientific discipline. He asserts that

> information is one of the most important resources for a nation and forms the integral base for the economic, cultural and scientific development of the country as a whole and periodicals are the main carriers of nascent thought and information. (Thanuskodi, 2010, p. 78)

The bibliometric study of a single journal can create a valid portrait of the periodical and provide a detailed multi-faceted picture of the characteristics of the journal (Nebelong-Bonnevie & Frandsen, 2006).

The inspection of the literature shows that the bibliometric analysis of single periodicals is quite frequent in the field of reflective meta-studies, and helps provide a critical overview of the situation in a given field (see, for instance, Crawley-Low, 2006; Govindaradjou & John, 2014; Minas, Wright, Zhao, & Kakuma, 2014; Petrina, 1998; Regolini & Jannes-Ober, 2013; Thanuskodi, 2010, 2011, etc.).

The authors have found several variables included in bibliometric studies that can be used to understand the characteristics of a journal, which in turn may reflect the features of the literature and communication behaviour in the fields they represent. Most often they are connected with the authors of the paper, the place of publication, titles, the length of publications, keywords, subject coverage, use of words and phrases in text, citation analysis, etc. (Kevin, Zainab, & Anuar, 2009; Regolini & Jannes-Ober, 2013; Thanuskodi, 2010, 2011; Wright & Pullen, 2007). Analysing 82 bibliometric studies, Kevin, Zainab and Anuar (2009) discerned the following bibliometric measures

used in different studies: article productivity (number of articles per issue, volumes and years indicating trendlines), author characteristics (gender, profession, rank, academic title, geographical affiliations by institution and institution type, region, country), authors' productivity (rank list of core and active authors), co-authorship patterns (types of co-authored works, degree of cooperation, local and foreign collaboration activities, etc.), content of papers (subject areas, keyword and title analysis, number of pages per article, types of research methodology and types of models and theories).

This paper is the first review in relation to JTEFS that was established only 13 years ago, and it is also among the few analytical reviews of single journals publishing research on sustainability in connection with education. The most familiar and globally recognized journals in this field are the *International Journal of Sustainability in Higher Education, Journal of Education for Sustainable Development*, *Sustainability: The Journal of Record*, *The Journal of Sustainability Education* and others. According to Barth and Rieckmann (2013), just a few comprehensive reviews on research in a field of ESD have been made, and only some of these have reviewed a single journal in this field to cover one specific research area.

In 2006, on the occasion of the tenth anniversary of *Environmental Education Research,* Reid and Scott already critically discuss the plans for the DESD using the bibliometric approach (Reid & Scott, 2006). However, it seems that the earliest review in the field of ESD was conducted by Wright and Pullen (2007), who conducted a bibliometric study of ESD journal articles in the ERIC database between 1990 and 2005. In a publication dated the same year, research trends in the US highlighting the movement from environmental education to ESD were analysed (Heimlich, 2007). A couple of years later Wals and Blewit (2010) analysed the thematic focus of the first nine years (2001–2010) of the *International Journal of Sustainability in Higher Education*. Vaughter et al. (Vaughter, Wright, McKenzie, & Lidstone, 2013) provided an exhaustive review of educational research on sustainability in post-secondary education within eight leading international journals publishing on sustainability and education. As already mentioned, Barth and Rieckmann (2013) presented a conference paper reviewing research in HE for SD based on an international literature review (1992–2012) analysing 509 articles in 110 journals. In addition, Barth and Michelsen have also conducted a bibliometric analysis focusing on the connection between educational and sustainability science (Barth & Michelsen, 2013).

As this paper will also target the knowledge gaps and research advances as well as try to identify emerging trends and controversies in research in TE for sustainability, one can assume that it contains some features not only from quantitative and qualitative bibliometric analysis, but also in terms of a literature review. Precisely as in a literature review, the authors will describe, synthesise and critically evaluate the research in relation to the problem under investigation. However, the difference is in the scope of the sources because in our case we will focus only on papers from a single journal. The features of the integrative review in this paper will allow us to provide new frameworks and perspectives on the topic, while the discourse of the historical review will appear in the analysis of developmental changes in JTEFS and showing the likely directions for future research. Undoubtedly, significant focus in this paper will also be on the methodological review, where the authors will deal with the underlying theories, research approaches, data collection and analysis (Fink, 2009; Petticrew & Roberts, 2009).

To describe the data analysis methods for this research, we should indicate that primarily quantitative bibliometric data was extracted and summarized by simple counting or labelling procedures while making inferences about the frequency of variables. This relates to the indicators of impact, databases, number of contributions per issue, representation of countries, institutions and authors, co-authorship patterns, number of references, citation rate, keywords, sample, data collection and analysis methods. In order to analyse the research paradigms, discerning the philosophical background of the studies, groups of keywords, research topics and some methodological features (research type, genre, orientation), both deductive and inductive coding approaches to textual data were applied as needed. To distinguish the groups of keywords and research topics, the inductive coding was performed, using semantic features from the title, keywords, abstract and main part of each paper, and analysing them in light of expert knowledge and academic experience in the field of TE for sustainability. To interpret the philosophical background (holistic theory, complexity theory, anthropocentric/non-anthropocentric divide), research type (empirical/theoretical, qualitative/quantitative/mixed method research), genre (effect/interpretative/participative/design research) and orientation (quantitative, qualitative, theoretical, participative orientation) reflected in journal articles, deductive coding based on the theoretical approaches described in the beginning of paper was involved.

Accordingly, we will analyse the bibliometric variables within a single periodical, covering all five areas discerned by Kevin, Zainab and Anuar (2009). The first chapter of the Results section will cover the indicators of impact, databases, number of contributions per issue, representation of countries, institutions and authors, co-authorship patterns, number of references and citation rate. The second chapter will elucidate on the research paradigms within the sample of journal papers, namely, the philosophical background of studies, keywords and research topics, and methodological features (research type, genre, orientation, sample, data collection and analysis). The bibliographic variables were chosen because of their relevance to the status, context and history of JTEFS – established in specific circumstances and with an exclusive mission for this very recent field of scientific studies. Therefore, the aim of this study is to explore the research output performance published in JTEFS during the last decade focusing on quantitative and qualitative bibliometric indicators and the research paradigms used. The following research questions will be answered in the subsequent analysis: 1) *What are the main bibliometric indicators of JTEFS (2005–2014)?* 2) *What are the distinctive elements of the research paradigms used in the papers published by JTEFS (2005–2014)?* and 3) *What developmental changes can be traced behind the main bibliometric indicators and research paradigms within the papers published in JTEFS (2005–2014)?*

Study Sample

The present study includes the articles, their authors and affiliation, abstracts, keywords and references at the end of each article, published in JTEFS from 2005 to 2014. The data pertaining to JTEFS includes 138 articles starting from volume 5 in 2005 to volume 16 in 2014. The first seven volumes out of the 18 volumes of JTEFS analysed in this study were published under the guidance of Anita Pipere as editor-in-chief, while the last 11 volumes appeared thanks to the leadership of Astrīda Skrinda in this position.

Results

Main Bibliometric Indicators (JTEFS 2005–2014)

Impact and databases. Currently, the SCImago Journal Rank for the journal is 0.217, SNIP – 0.256, Impact per Publication – 0.222 (data from 2014). The journal is included in the following database: Cabell's Directory, CABI – CAB Abstracts, CEJSH (The Central European Journal of Social Sciences and Humanities), Celdes, CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, EBSCO – TOC Premier, EBSCO Discovery Service, Educational Research Abstracts Online, Elsevier – SCOPUS, ERIH PLUS, Google Scholar, J-Gate, JournalTOCs, Naviga (Softweco), Primo Central (ExLibris), ProQuest (relevant databases), ReadCube, SCImago (SJR), Summon (Serials Solutions/ ProQuest), TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, Wiley – Higher Education Abstracts and WorldCat (OCLC). The JTEFS is the only journal in Latvia in the area of education included in SCOPUS.

Representation of countries, institutions and authors. The journal has two issues per year. The number of articles per volume in the target decade ranged from 6 to10 articles – 7.7 articles on average per volume. The papers for JTEFS have been received from 26 countries across the world, representing all five continents. However, the distribution of papers among the countries has been rather imbalanced. Five countries have provided about 50% of the total published articles (Latvia – 28.3%, Estonia – 18.8%, Finland – 8%, USA – 8%, Greece – 6.5%). However, only 3.6% of the articles have been authored by scholars from different countries designating the cross-country authorship, many more have been created via the collaboration of different institutions within a single country.

The leading institution with 24.6% of publications in JTEFS from 2005 to 2014 was Daugavpils University, though this is not surprising since the journal has been established, managed and led from this university. Tallinn University as a close partner of Daugavpils University in BBCC has also been extensively represented with 18.1% of publications in this journal. Several publications also came from such institutions as the University of Helsinki (4.3%), University of Malta (4.3%), University of Crete (3.6%), University of Eastern Finland (3%). The names of the leading authors also match the list of leading universities: D. Iliško (Daugavpils University) tops this list with 6 articles (authored and co-authored), following by K. Lukk (5 articles) from Tallinn University, 4 articles have been published by I. Salīte, L. Jonāne, I. Mičule from Daugavpils University, M. Veisson from Tallinn University and V. Makrakis from the University of Crete.

From 138 articles, 59.4% were written or co-authored by men that suggests a rather balanced gender distribution in this field of educational research. Just under forty per cent (39.9%) of the articles were written by a single author, other papers were authored by two to six authors – two authors being the average number of authors per paper. Among the main authors of papers, 31.9% were PhD students.

Number of references and citation rate. Average number of references per article is 30.5 references ranging from 7 to 105 references. Authors have cited articles from JTEFS 93 times, on average 5.2 times per volume. Two volumes do not contain any citations from JTEFS, while one volume contain 18 citations from this journal.

The largest citation rate in SCOPUS (6 times each) during the examined period was received by two articles from JTEFS: "Educational action research for sustainability:

Constructing a vision for the future in teacher education" by Salīte (2008) and "Educational action research for sustainability: Seeking wisdom of insight in teacher education" by Salīte, Gedžūne and Gedžūne (2009). In total, starting from 2006, 24.6% of articles from JTEFS were cited in SCOPUS at least once.

Research Paradigms (JTEFS 2005–2014)

Philosophical background of studies. Close exploration of the content of the articles indicates that almost every author mentions some philosophical concepts or theory. However, not all of them elaborate on this philosophical discourse. The analysis of the papers proves that 34 (25%) papers comprise more or less a pronounced integration of philosophical concepts, theories and approaches. Later, we will provide more detailed analysis in terms of holistic theory – a precursor of complexity theory, complexity theory itself as well as the anthropocentric/non-anthropocentric divide – the most frequent philosophical trends noticed in JTEFS (2005–2014).

Nineteen (13.8%) of the papers were found to refer to holistic theory, the concept of holism or holistic principles or strategies in some way. To provide some examples, Iliško (2005) explains the connection between holism and education and asks teachers to evaluate their orientation toward the idea of a holistic curriculum; Armstrong and LeHew (2011) apply holistic principles in order to transform the university course *Private Label Apparel Product Development* toward sustainability; Badjanova (2013) uses a holistic approach to facilitate the acquisition of musical cultural values among primary school students. Interestingly enough, 13 papers embracing holism belong to authors from the Baltic states.

The articles integrating complexity discourse were mostly theoretical. Seven articles integrated complexity theory starting from a simple mention of complexity to a rather extended description of an incorporated principle or strategy of complexity. In two articles complexity theory was just referred to, while in another two publications the authors have used complexity theory as one of the key background theories in their theoretical work – to explain knowledge systems for SD and sustainability (Wensing & Torre, 2009), and to foster an ontological shift in perceptions of reality through weaving rhizomatic principles with the processes of ESD (Tillmanns, Holland, Lorenzi, & McDonagh, 2014). Three other articles can be viewed as impinging on several complexity principles and strategies: interdiscursivity through weaving together the topics of water and justice (Dimenäs & Alexandersson, 2012), self-organisation depicting the emergence of a sustainability plan at a large US college (Smith, 2011), and perceptions of the school environment through the nesting of several systems (Katane, 2007).

It should be noted that some other philosophical trends or authors were also alluded to in some articles, for instance, humanistic philosophy (Kuurme, 2008), Heidegger (Iliško, 2007), Blondel (Mandolini, 2007), Levinas (Holland, Mulcahy, Besong, & Judge, 2012) and others.

It was found that ten articles contain explicit reference to the anthropocentric/non-anthropocentric divide or critique of anthropocentrism. These were all theoretical papers or papers containing case studies or qualitative methodology. The divide between anthropocentric/non-anthropocentric approaches was used in articles by Salīte, Gedžūne and Gedžūne (2009), Kostoulas-Makrakis (2010), Gedžūne and Gedžūne (2011), and Buttigieg

and Pace (2013) – these authors used this divide mainly to evaluate the views of research participants. The critique of anthropocentrism was oriented mostly toward normative definitions and approaches in the field of sustainability (Bentham, 2013; Cutanda & Murga-Menoyo, 2014; Eriksen, 2013; Mandolini, 2007; Pipere & Mičule, 2014; Smith, 2011).

Content of papers: keywords and topics. The keywords and topics of JTEFS papers (2005–2014) will be analysed both from a qualitative and quantitative point of view. In total, 138 articles contained 619 keywords. The largest group of keywords (n = 107) was constituted by different terms in relation to **cognitive activities, teaching/learning processes** and **individual features of students and teaching**. This group contained keywords in such fields as learning (n = 16) (e.g., e-learning, online, transformative, meaningful, lifelong, language, cooperative, self-directed, social-constructive, blended, problem-based, mutual learning), evaluation/assessment (n = 8), learning/educational environment (n = 7), thinking (n = 5) (e.g., dialectic, critical, systemic ecological, complex thinking), reflection (n = 4), knowledge (n = 3), and frame of reference (n = 2). Three large groups of keywords standing out in this category are "competence" (n = 16), "curriculum" (n = 13) and "creativity" (n = 7).

Out of 619, 87 keywords in general retain the concepts of **teacher, teacher education/ training/preparation, teachers' professional development** and **teaching activities**. All together, the keywords regarding "teacher/s (including some specifications)" were used 28 times, while "teacher education/training/preparation" sometimes applied either to pre-service or in-service teachers were used 27 times.

The keywords regarding teachers' professional development (n = 17) were also represented (e.g., teachers' competence (2), teacher professional learning, teachers' beliefs, teachers' Standard of Professional competence, teachers' roles, teachers' voice, teachers' evaluation, teacher development, head-teacher–teacher relationship, co-teaching in teacher education, mentoring in teacher education, collaborative teaching in teacher education, teacher-carried research, teachers' personal and professional growth, teachers' autonomy, student teachers' identity). The following keywords depict teaching practice – "teaching" (3), "teaching/pedagogical practice" (2), "teaching of mathematics", "train-the-trainer", "reflective teaching", "teaching methodology", "teaching process", "instructional practices" and "teaching methods". Some other keywords attuned to this group were "teacher education programs" (2) and "adult educator".

The other large group – 83 keywords, were words or phrases containing the terms **"sustainable"** or **"sustainability".** The keyword "sustainable development" was used 20 times, while "sustainability" was mentioned 11 times. To show the connection between education and sustainability, 23 articles contained the keyword "education for sustainable development", and such phrases as "sustainable education" (2), "education for sustainability" (2), "teacher education for sustainability", "sustainability pedagogy", "pedagogical model for sustainable development", "educational unsustainability" and "sustainability literacy" were also observed among the keywords.

Furthermore, some other connections with sustainability were displayed in keywords such as "sustainable leadership (skills, abilities)" (3), "sustainable changes" (2), "sustainable communities", "sustainable community of practice", "sustainable human development", "sustainable energy", "sustainability plan", "sustainability perspective", "environmental sustainability", "sustainable school indicators", "sustainable school", "sustainable

behaviours", "sustainability competences", "sustainable design", "features of sustainability" and "features of unsustainability".

The next largest group of keywords (n = 67) relates to **education**, among them several groups of concepts pertaining to the type and level of education were found (e.g., preschool education (9), higher education (5), primary education (5), education (3), further education (2), secondary education (2), general education (2), non-formal education (1)). Other keywords manifested different content areas of education (e.g., environmental education (9), climate change education (2), energy education (2), holistic education (2), art education (2), natural science (2), civic, science, special, performative, health, practical, technology, career, vocational, multilingual, future, entrepreneurship, multicultural, cross-cultural, inclusive, physical education). Also, such keywords as "diversity in education", "education policies", "higher education institution" and "change in educational paradigm" can be attributed to this group.

The group of keywords illustrating **the research** performed in the papers is smaller (n = 24). The largest number (7) is connected with action research: "educational action research" (4), "action research" (2) and "participatory action research" (1). In general, all other keywords that related to research methodology illustrated elements connected with qualitative research, including "narrative (inquiry)" (3), "qualitative research", "photo-interview", "lesson observation", "journal keeping", "reflective writing", "SWOT analysis", "case study", "design-based research", "interpretative phenomenological analysis", "content analysis", "representation", "concept mapping" and "questionnaire". Just one keyword ("correlation") can be associated to quantitative research.

Other keywords represented the large array of smaller groups of concepts in connection with different educational stakeholders and their actions, elements of teaching/learning approaches and theories.

Now let us turn to the other features of articles characterizing their essential content – the topics of papers. The largest group of papers, which can be easily divided in three subgroups, relates to the **various school subjects and areas** (32 or 23.2%): 12 papers were connected with the area of environment, science, mathematics, technology; 10 papers dealt with the popular trend of ICT for ESD, while another 10 papers demonstrated the connection between ESD and teaching/learning in art, music, physical education, health education, foreign language and native language acquisition. This group can be illustrated by the papers "Interdisciplinary mathematics and science education through robotics technology: Its potential for ESD (a case study from the USA)" (Gerretson, Howes, Campbell, & Thompson, 2008) and "The Finnish five-string kantele: Sustainably designed for musical joy" (Ruokonen, Sepp, Moilanen, Autio, & Ruismaki, 2014).

Authors of JTEFS often went in for topics connected with the **professional development of pre-service/in-service teachers and their views on different issues in education and ESD** (27 or 19.6% papers). This group of papers can be represented by the papers by Nurmilaakso (2009) "Preschool and primary school children as learners in 2030: Views of Finnish student teachers" and Manolas and Tampakis (2010) "Environmental responsibility: Teachers' views".

A further topic that was studied quite often was **school/educational environment, its issues and connection with ESD** (23 or 16.7% papers). This group is well represented by the papers "Parental involvement in the framework of holistic education" (Lukk,

2005) and "Sustainable school indicators: Approaching the vision through the sustainable school award" (Kalaitzidis, 2012).

Theoretical issues and research in pre-service/in-service teacher education for ESD were dealt with in 18 papers (13%); for instance, "Developing and applying a critical and transformative model to address ESD in teacher education" (Kostoulas-Makrakis, 2010) and "Effecting change through learning networks: The experience of the UK teacher education network for ESD and global citizenship" (Inman, Mackay, Rogers, & Wade, 2010).

Nine papers (6.5%) interpreted **preschool education theory and practice**, while seven articles (5.1%) analysed **methods, materials and resources for EE and ESD**. These two categories can be illustrated by Härkönen's (2009) "Pedagogical systems theory and model for sustainable human development in early childhood education and care" and the paper by Vanhear and Pace (2008) "Integrating knowledge, feelings and action: Using Vee heuristics and concept mapping in education for sustainable development".

Several contributions were devoted to the **development of curriculum** (6) and **teachers' induction, mentoring and pedagogical practice** (5). These topic groups can be exemplified by the papers "Course curricular design and development of the M.Sc. programme in the field of ICT in ESD" (Makrakis & Kostoulas-Makrakis, 2012) and "Developing reflective practice in the classroom: A case study of ten newly qualified teachers during their year of induction" (Jones, 2005).

For 10 articles (7.2%), it was hard to identify their topic as belonging to some content category mentioned above as they covered areas only marginally connected with TE for sustainability. It should be mentioned, that some papers contained several (at least two) content areas by which they could be included in one or another topic group.

Methodological features. The methodological features of the papers will be described in the following order: we will start with the characteristics of research type, then use classifications by research genre (Borko et al., 2007) and the model of agentive perspective (Reunamo & Pipere, 2011), and finally we will turn to the features of samples and methods of data collection and analysis.

The majority of the articles (99 or 71.7%) represented some type of empirical research, 11.6% of papers contained both innovative theoretical elaborations and empirical research, while 16.7% of papers comprised theoretical interpretations of different topics. In terms of methodological preferences in empirical studies, qualitative research was represented more than others (35.5% of papers), following by quantitative studies (28.3% papers) and mixed methods research designs (16.7% papers). In the case of 3% of empirical papers, their methodological affiliation was hard to identify. Out of all the empirical papers, 10.9% contained the diverse interpretations of project evaluations, while only 3.6% could be called comparative studies (e.g., Keinonen et al., 2014; Rohweder & Virtanen, 2009; Vartiainen & Enkenberg, 2013).

The analysis of empirical papers in terms of belonging to one or another research genre was not easy, since quite a number of authors did not especially elaborate and accurately reveal the genre while describing the methodological features of their study. The largest group of empirical papers in JTEFS (2005–2014) can be attributed to the interpretative research genre (26.1% of papers). As examples of this genre, we can mention the papers "Sustainable education and socialization through mistakes" (Leino, 2007) and "Mathematical identity for a sustainable future: An interpretative phenomeno-

logical analysis" (Pipere & Mičule, 2014). The next largest group of 25 (18.1%) articles was classified as belonging to the participative research genre. This group can be illustrated by the papers "Educational action research for sustainability: Seeking wisdom of insight in teacher education" (Salīte, Gedžūne, & Gedžūne, 2009) and "Developing a sustainability plan at a large U.S. College of education" (Smith, 2011). The smaller group, consisting of 14 (10.1%) papers, was allocated as design research devoted to the development and testing of appropriate educational environments. As good examples for this group, we can name the papers "Qualitative education for Roma students: A pedagogical model for sustainable development" (Zaķe, 2010) and "Educative experience of the use of concept mapping in science and environmental teacher training programmes" (Pontes-Pedrajas & Varo-Martínez, 2014). The smallest group was effect research, only represented by 11 (8%) papers. For instance, Jonāne (2008) in her paper "The didactical aspects of integrated natural science content model for secondary school education" uses the quasi-experiment to prove the effect of an integrated science content model on pupil achievement, while Ficarra and Quinn (2014) in their paper "Teachers' facility with evidence-based classroom management practices: An investigation of teachers' preparation programmes and in-service conditions" look for the correlation between teacher knowledge and competency ratings for evidence-based practices. Thirty (21.7%) papers were left outside of this type of classification as they did not correspond to the general descriptions of genres (Borko et al., 2007). These papers mostly contained quantitative descriptive research using percentage, descriptive statistics and group differences.

The application of the model of agentive perspective (Reunamo & Pipere, 2011) in the papers under analysis showed the heterogeneity of the studies, as many of them contained features of not just one, but also two or three orientations of this model. However, this mode of classification made it possible to categorize all empirical articles without exemption. The largest three groups were studies with quantitative (27 or 19.6%), theoretical (22 or 15.9%), and qualitative/participative (22 or 15.9%) orientations followed by two smaller groups of qualitative (15 or 10.9%) and qualitative/quantitative/participative (13 or 9.4%) orientations. In the group with the least frequent orientations overall, qualitative/quantitative research is the most frequent (9 or 6.5%), followed by theoretical/qualitative (6 or 4.3%), theoretical/quantitative (6 or 4.3%) and theoretical/qualitative/participative (6 or 4.3%) research. Just a few studies represented quantitative/participative (4 or 2.9%), participative (3 or 2.2%), theoretical/participative (3 or 2.2%) and theoretical/quantitative/participative (2 or 1.4%) studies.

In general, according to Reunamo's four-fold model of ESD research (Reunamo & Pipere, 2011), the focus on the subject's content and teaching approaches is aligned solely with an assimilative orientation of the model, using mostly theoretical and quantitative points of view (e.g., Jonāne, 2008; Šapkova, 2011) while an accommodative stance on understanding the motifs and discourse of SD as meta-content or meta-message could be found in qualitative research of individual participant interactive processes (e.g., Pipere & Mičule, 2014; Raus & Falkenberg, 2014; Gedžūne, & Gedžūne, 2011, etc.).

Looking at the research samples usually says a lot about the focus of the study, all together, 13 different populations were engaged in the studies – in-service teachers, pre-service teachers, pupils K–12, university students, parents, youth, adult educators, teacher educators, university staff, university graduates, mentors, principals and experts. The largest number of papers dealt with in-service teachers (37 or 26.8% of papers), which

is perfectly understandable given the title and policy of JTEFS, the next largest group was pre-service teachers (17 or 12.3% or papers), then pupils K–12 (15 or 10.9% of papers) and university students (10 or 7.2% of papers). Twenty one (15.2%) papers contained an empirical study based on mixed samples, for instance, in-service and pre-service teachers, in-service teachers and primary school students, or pre-service teachers, mentors and teacher educators.

As the descriptive statistical analysis shows, the largest samples were used for quantitative studies with a range from 11 to 7,134 participants (M = 948.16; SD = 1972.29; Mdn = 198). The smaller samples were encountered in mixed methods research papers. They ranged from 16 to 1,055 participants (M = 190.32; SD = 220.96; Mdn = 121.5). In concordance with accepted rules and research tradition, the smallest samples were engaged in qualitative research involving from 1 up to 1392 participants (M = 80.23; SD = 216.29; Mdn = 24). Just a few authors have described their sampling approach, although, it can be assumed that, in general, all qualitative studies used purposeful research sample. As for the quantitative and mixed methods research, the authors mostly used non-probability sampling: most often they collected data from convenience samples, much less often – from purposeful samples. Only three papers contained mention of random sampling, and one paper contained the description of a study using a stratified sample.

Turning to the data collection design and method, the analysis of papers showed that about half of the empirical papers contained one research method (53.4%), two research methods were employed in 22.6% of papers, three research methods were used in 9.6% of papers, while four research methods in only 6.1% of papers. However, it should be noticed that for 8.3% of papers, the research method was not discernible or the authors just mentioned the research design, in these instances primarily case study. In regard to research designs, as has become popular in ESD research, a notable number of authors resorted to case studies (13.9%) and action research (7%). Ethnography, grounded theory research and experimental designs were used just in a couple of the studies. In regard to the frequency of the administered data collection methods, the methods will be categorized according to the distribution of data collection methods in the review by Barth and Rieckmann (2013) so as to make the subsequent comparison possible. Since about half of the studies contained several data collection methods, we will reflect the distribution of the methods using the natural numbers of the papers where such a method was used. Hence, surveys were the largest group of methods (73 or 52.9% of papers), followed by interviews (32 or 23.2%). Tests/assignments (16 or 11.6%) and focus groups (14 or 10.1%) were used less. Only 10 (7.2%) papers contained document analysis, while observation was applied in just 8 (5.8%) papers. Eleven (8%) papers described the use of other data collection methods (e.g., writing essays, written narratives, narrative story telling, analysis of reflective journals of students, researcher's field notes, SWOT, artefacts).

In regard to the data analysis methods, these will be divided by methods for analysing qualitative and quantitative data, and their frequency will also be reflected in natural numbers. In papers using qualitative data (72 or 52.2% in total), the two prevalent methods were qualitative content analysis (36 or 26.1% of papers) followed by thematic data analysis (15 or 10.9%). Other methods were employed very rarely (e.g., phenomenological analysis (3), discourse analysis (2), narrative analysis, continuous comparative

analysis). In terms of a combination of qualitative data analysis methods, the majority of qualitative or mixed method research papers included just one qualitative data analysis method. It was observed that a large number of authors did not describe their specific qualitative data analysis method, rather merely indicating their use of qualitative data analysis. In addition, a small number of authors inserted references to scholarly sources when describing their qualitative data analysis method.

About half of the papers dealing with quantitative data (62 or 44.9% in total) comprised the calculation of the percentage of obtained categories of answers, scores, and so on (29 or 21% of papers); in such papers, usually only one approach to data analysis (percentage calculation) was applied. However, a statistical analysis was also performed in some of quantitative or mixed method research papers using descriptive statistics (means (17 or 12.3%), frequency distribution (11 or 8%), correlation (5 or 3.6%), Chi-square (4 or 2.9%)) and inferential statistics (Student t-criteria/Mann-Whitney criteria (18 or 13%), ANOVA/Kruscall-Wallis test (10 or 7.2%), factor analysis (4 or 2.9%), cluster analysis (3 or 2.2%), regression analysis (2 or 1.4%)). In papers with statistical analysis, several statistical data analysis procedures were usually applied to the quantitative data.

The Main Bibliometric Indicators and Research Paradigms (JTEFS 2005–2014): Developmental Changes

Looking at one of the most important bibliometric indicators of the journal – inclusion in international databases – shows that in 2007 JTEFS was included in CABI - CAB Abstracts and SCOPUS (Elsevier Bibliographical Databases), then in 2009, agreement with De Gruyter Open (formerly VERSITA) regarding the electronic open access to journal papers ensured the further inclusion of JTEFS in other databases and services (like EBSCO, ERIH, etc.). From its establishment in 2002 until 2007, the journal only had one issue per year, but starting from 2008 there were two issues per year. The change of title from the *Journal of Teacher Education and Training* in 2002 to *Journal of Teacher Education for Sustainability* in 2007 designated a more tenable demand for the specific content of the papers; however, it should be noticed that the change of title did not send the topics and content of the journal papers in an entirely new direction. From its inception in 2002, the main unifying platform for research was already sustainability or ESD in regard to TE, even if the concepts were not always explicitly described or sustainability was not mentioned as the theoretical platform or measured as a variable.

In the period from 2005 to 2010, papers from Latvia and Estonia dominated the journal, but from 2011, the share of these countries started to decrease and the number of papers from other countries clearly increased. While the first part of this period evidenced a lack of cross-country authorship, the last years show the gradual increase of such papers. In terms of contributions by doctoral students, we can see a slight decrease – from 2005 to 2008 on average 3.3 papers per volume were by doctoral students, while from 2009 to 2014 on average only 2 papers per volume were by doctoral students.

We will now turn to the development of research paradigms in the suggested period. At the beginning (2005 and 2006), about 50% of the papers included holistic approaches, then from 2007 to 2009 only one paper contributed to holistic discourse, and from

2010, holistic theory experienced a revival with two authors using this approach each year. The majority of these are empirical papers with a qualitative orientation, although some articles also employed quantitative or mixed method approaches, and a few were theoretical papers. About half of these papers pertaining to the holistic approach were created by Latvian authors.

The application of complexity theory was not consistent either – in the beginning of the period its use was rather uneven (no reference to such a theory in 2005, 2006, 2008 or 2010), but from 2011 at least one paper per year contains references to this theoretical discourse. The majority of these articles are theoretical contributions or theoretical discussions with a trace of an empirical disposition.

The implementation of a critique of anthropocentrism shows steady growth from 2007. In 2013, three papers already featured both a critique of anthropocentrism and an exploration of the anthropocentrism/non-anthropocentrism divide. As with papers involving complexity theory, these papers are theoretical or clear representatives of the interpretative genre.

Our analysis of the development of JTEFS in terms of research topics does not indicate any pronounced trends; all 8 topics are distributed throughout the period rather evenly. However, several clusters of topics can be observed in different sub-periods; for example, clusters on the topic of **various school subjects and areas** – 6 articles in Vol. 13, 2011 and 4 articles in Vol. 16, 2014; or **professional development of teachers and their views on education and ESD** – 5 articles in Vol. 6, 2006 and 5 articles in Vol. 16, 2014. Clusters of articles were also identified on the topics of **curriculum development** – 4 articles in Vol. 14, 2012 and **issues of school/educational environment and connection with ESD** – 4 articles in Vol. 5, 2005.

The analysis of the development of methodological approaches did not show any peculiar trends or increase; the distribution of different approaches from 2005 to 2014 can be described as a slight undulation of mixed and theoretical research with some larger waves of quantitative exploration on a steady surface of qualitative studies. Only two exceptions were noticed – a volume with 6 quantitative studies in 2005, and 6 theoretical studies in Vol. 14 in 2012.

A wide diversity appears in terms of research genre: in regard to qualitatively oriented genres one could say that both interpretative and participative genres are rather evenly distributed during the studied period; although, the interpretative genre is completely missing in 4 volumes, while the participative genre was not found in 6 volumes. However, the patterns differ, showing some depression in the middle of the period for the interpretative genre and an upswing for the participative genre in precisely this same period. Effect research was found to be rather evenly dispersed through the whole period, while for design studies the period of greater activity was observed in 2009–2010.

The description of research development in accordance with the agentive model (Reunamo & Pipere, 2011) starts by noticing the continuous presence of "pure" quantitative research during the whole period from 2005 to 2014 (with the exception of three volumes towards the end of this period). The numbers of theoretical research rises towards the end of the studied period. While "pure" qualitative research dominates in the first half of the period, the second half stands out for the noticeable growth of mixed method research including different combinations of qualitative, quantitative and participative orientations. The combination of a theoretical stance with other orientations emerges both in the beginning of reviewed period and re-enters again from 2011.

In regard to data collection methods, the most popular methods of survey and interview appear rather evenly during the whole period under analysis, with the only exception being that interviews are missing in Vol.11, 2009.

No specific developmental trends were found in terms of the sample volume or type of population – these variables were primarily connected to research methodology or genre; the only noticeable factor was very large samples sometimes used by Estonian authors in their quantitative research papers.

In terms of data analysis methods, only 2011 and 2012 show a lack of thematic analysis as a data analysis method for qualitative data, all other volumes represent one or two papers with the application of this method. The use of content analysis was observed in each volume during the studied period, with the greatest incidence being (4 papers per volume) in Vol. 13, 2011 and Vol. 16, 2014. Statistical data analysis was utilized unevenly during the studied period, and was totally missing in three volumes: Vol. 8, 2007, Vol.11, 2009, and Vol. 14, 2012, while in other periods, the number of studies using statistical analysis of quantitative data varied between one and three papers per volume.

Discussion and Conclusions

This chapter will be structured in line with the research questions and framework of the results section, simultaneously echoing the criteria and qualities challenging research in TE for sustainability reflected at the beginning of the paper.

Main Bibliometric Indicators (JTEFS 2005–2014)

The description of bibliometric indicators for JTEFS is not an end in itself, as they can help illustrate changes, and feature both the successes and difficulties of the research.

In comparison to other journals exploring a similar topic, the representation of JTEFS in databases has been quite successful and, although inclusion in SSCI is yet to be achieved, the indicators of the journal's ranking and impact have improved and show the clear development of the journal's quality. However, the rate of article citation in SCOPUS has to be improved, although this is hard to do in such a narrow research area. Admittedly, this coverage cannot compete with other journals on TE published in Western countries with completely different levels of resources and lengths of experience, and besides, this method of evaluating scientific activity favours publications established in Anglo-Saxon countries (Archambault & Vignola-Gagné, 2004). As professional experience shows, even if included in reputed databases, journals from Eastern Europe will have lower prestige and consequently lower citation rate and international ranking. Besides, the authors have observed a more or less conscious citation bias towards authors from Anglo-Saxon countries. Although, the citation rate and similar indicators currently have very high support from Latvian political decision-makers in education and research, who believe that evaluations based on these measures could help boost the competitive capacity of Latvian scholars on a global scale, this approach overlooks at least two arguments: first, the idea that with the present system of publication, research promotion and grant distribution, scholars in the natural sciences will automatically reach the higher scores; and second, such measures of research quality will rather reproduce normative,

adaptive research instead of facilitating studies with novel and controversial approaches that would be very appropriate for sustainability science.

Therefore, to evaluate the success of JTEFS we have to compare this periodical with periodicals from similar countries and research fields and consider the scientific and educational context and historical background of Latvia as well as the fact that the first international peer-reviewed academic journals in education appeared in the Baltic states only about a decade ago.

With regard to the geographical range of contributions, it should be noticed that the editorial board at JTEFS does not have any bias toward the national affiliation of the authors – the only requirement is the quality of the contribution, although, the national origins of the authors need to be diversified to avoid the dominance of Western countries. In addition, cross-country authorship should be facilitated as it usually enhances the number of comparative studies. The leading universities and authors in terms of numbers of publications in JTEFS have been from the long-term partners of the BBCC and/or other international projects that once again underscore the role of networking in capacity building for sustainability research.

Research Paradigms (JTEFS 2005–2014)

The integration of some philosophical approaches or concepts in about a third of the papers is a self-evident feature, since more than half of the contributions contained some indication of the interpretative paradigm. Qualitative studies usually comprise a stronger emphasis on philosophical approaches than quantitative studies; for example, they are used to explain qualitative designs or interpret qualitative data. The most frequent choice for many authors in respect to their philosophical position has been the holistic philosophy that has been acknowledged as a predecessor of complexity theory (Heylighen, Cilliers, & Gershenson, 2007) and has been rather admissible among educational researchers and studies in teacher education in the last few decades (e.g., Kettley, 2012). The field of environmental education and sustainability education has already tried to expose the explanatory power of this approach. In the case of JTEFS, members of ISE (the organisation that founded JTEFS) focus on holism in their research and practice allowed them to bring this approach into the philosophical vocabulary of the BBCC network and manifest it in many publications within JTEFS. The implementation of complexity discourse in several theoretical papers indicates that this new theory has strong potential for educational research for sustainability that needs to be developed further and enriched with convincing empirical evidence, although it seems that due to some critical moments for this theory, this could take rather a long time. The critique of normative approaches in ESD suggested by several authors (Knutsson, 2013; Kopnina, 2012; Öhman, 2011) is well reflected in articles dealing with anthropocentrism in definitions, conceptions, and views of teachers and learners; however, this approach appears more often in recent papers.

The distribution of the largest groups of keywords and topics can also provide an insight into the content priorities in TE for sustainability research. The interpretation of keyword categories shows the expansion of the semantic emphasis on the epistemological and ontological aspects of teachers' work regarding the specific features and processes of teaching/learning that designate the essence of teacher and learner. This understanding

is followed by the making of this essence through educational, training and development aspects inherent for this profession as well as specific work activities and the specifics of this journal in terms of sustainability. The field of activities – education and research methodology – is represented at the lowest rate. The powerful dominance of essentially educational entities refutes criticisms (Sund & Lysgaard, 2013) of a loss of focus on educational processes in ESD research; therefore, here we should strive for a sound intermingling of educational and sustainability aims in every research.

Considering the topics of the articles, the dominance of contributions connected with the integration of sustainability in various school subjects and fields obviously attests to the specialization of the authors such as the university teachers or PhD students teaching these subjects or their methodology. Besides, such a diversity of disciplines and areas is already integrated into the journal's politics and guidelines. Interestingly, the fact that this is also the second most popular topic in the *Journal of Higher Education for Sustainability* (Wals & Blewit, 2010) after the topic of campus greening, shows the gradual spread of sustainability outside the more traditional areas of environmental education and science. The next largest topic related to the professional development and views of teachers relates to the teachers themselves and their perception of sustainability matters. Such topics are also quite popular when embarking on research in any new field in social studies, which needs to identify the real situation and attitudes of actors so as to move forward. A large proportion of the papers related to the educational environment in connection with ESD designates both the holistic research approach as it deals with the context of the studied phenomena and the clear need to explore the state of sustainability in education. In general, the topics covered by the articles in JTEFS match the topics discovered in a previous international survey of ESD researchers (Pipere, Reunamo, & Jones, 2010), especially in regard to examining the current situation, changing the awareness of stakeholders in the educational process in regard to sustainability and contextualised educational models. Much fewer studies have been devoted to research into the changing behaviour and lifestyles of student teachers, in-service teachers or school pupils towards more sustainable choices. The integration of ESD into pre-service and in-service TE programmes was evaluated more at the level of local action research than as cross-comparative global studies. Youth involvement in ESD activities was also explored only in a couple of papers. In future, the number of papers only marginally connected with TE for sustainability should be considerably reduced.

In terms of methodological features, the distribution of methodological approaches in JTEFS papers in general coincides with the distribution of empirical and theoretical papers in other journals publishing educational research. The small number of theoretical studies can be explained by the fact that they usually address innovative and challenging approaches and concepts that are not so easy for less experienced researchers, teacher trainers or PhD students to develop. The proportions of qualitative, quantitative and mixed method research are quite equal, while comparative research needs considerably more development. However, according to genre classification, the trend toward interpretative and participative research dominates in the papers as a common practice in TE research (BERA, 2014; Tatto, 2013). This is in line with the calls for participative and transformative research in the field of sustainability education; however, effect research was essentially missing in JTEFS. Here, one should recapture AERA's recent calls for a positivist paradigm, and take a guess, either this lack of effect research is caused by the passionate echoing of the need for contextualised local research on sense-making in

terms of sustainability by merely avoiding a research paradigm that asks for certain specific research skills, or due to a lack of resources for conducting rigorous quantitative research with random samples or comparative research involving several countries. The heterogeneity of the published studies in terms of the agentive perspective (Reunamo & Pipere, 2011) showed that research in TE for sustainability in general cannot be performed using a single approach or method. The participative orientation was found to be integrated both in qualitative and mixed method research; the only mode of research that did not involve the participative orientation was quantitative. However, the authors need to improve their skills in describing the methodological approach of their studies, especially in participative studies where the interest in practical activities and real-life engagement sometimes outshines the necessity to follow the requirements of a proper scientific report.

In general, the involvement of samples in the analysed papers was appropriate for the research problem and topic; the heterogeneity of the samples indicates the breadth of educational stakeholders involved in sustainable education, while use of mixed samples make the improvement of scientific rigour through data triangulation possible (Denzin, 1970). Again, the sampling approach and the samples involved should be depicted carefully and in detail. In addition, the researchers should not avoid probability sampling in quantitative studies that would enable the extrapolation of results from the studied population.

In connection with data collection methods, it was observed, especially for case studies, that the authors did not mention the research design or method. Compared with the findings in the study by Barth and Rieckmann (2013), a large share of the research also used case studies in JTEFS; however, considering data collection methods, the picture is somehow different. In their review of 110 journals on sustainability, the three most popular methods were surveys, document analysis and interviews; in JTEFS, the most frequent methods were surveys, interviews, tests/assignments and focus groups, which probably indicates the orientation of the research as focusing more on the practical elements of and "life-experience" within TE for sustainability. The detailed study of data analysis methods suggests a more nuanced diversification and the better scientific quality of both qualitative and quantitative data analysis methods in accordance with the research context and the refined description of these methods so as to allow peers to correctly repeat the study.

Along general lines, the articles published in JTEFS meet the demands of AERA in terms of multi-methodological approaches; however, as stated above, the description of the methods for data collection and analysis, the connection between TE and student learning as well as engagement with multi-institutional and multi-national studies need to be seriously improved. Nevertheless, the authors in JTEFS have rather successfully surmounted the dichotomies between researcher and practitioner and qualitative, quantitative and interpretative studies (Smeyers, 2008), which also indicates the holistic approach applied as the research methodology.

JTEFS 2005–2014: Surfing the Tide of Knowledge

The growth of JTEFS in terms of acceptance in databases was unexpectedly fast and successful; perhaps the change of the journal's title, the selfless work of its editorial board, developments in the BBCC network and recognition from UNESCO have been the most significant inspirational factors in this process. The greater numbers of papers

authored by researchers from Daugavpils University (mostly ISE) at the beginning of the period analysed can be viewed not as a flaw in terms of authorship, but as start-up capital, since ISE was the place with innovative ideas for TE in sustainability education and globally recognized capacity for the further development of these creative ideas (UNESCO, 2009). The slight decrease in papers by doctoral students toward the end of the period can probably be explained by the growing interest in this journal from a more diverse population of researchers.

In order to portray the features of the cumulative knowledge building at JTEFS, we will attempt to use Legitimation Code Theory (Maton, 2014), which suggests that knowledge can be expressed in semantic waves – strengthening and weakening context-dependence and the concentration of meaning. It is recognized that semantic waves are a key characteristic of educational and intellectual practice and this seems to be the first attempt to use this theory to explain the development of a research paradigm in a single journal. Legitimation Code Theory uses codes of semantic gravity that refer to the degree of abstraction or degree to which meaning relates to context and semantic density that refers to the degree of the growth in complexity or of the concentration of meaning within practices.

As just stated, the beginning of the period analysed featured a large number of authors from ISE and their network partners that made the holistic approach popular among them, then the number of such publications decreased with the decline of holistic theory, although, researchers from other countries soon intercepted this and continued its development. At the end of the period, holistic theory had already developed into the more abstract and higher level complexity theory used mainly in theoretical papers. In terms of innovative theoretical development, it can certainly be traced more clearly in theoretical or interpretative research; however, some theoretical development would also be advisable in quantitative studies. The wavelike structure of the research focus is also depicted in the clusters of research topics discerned in the previous chapter with the ebb and flow of some topics in different intervals of period analysed.

Waves in the development of the research paradigm can also be traced in terms of theoretical and empirical papers: from abstract, generalized, complex meaning in theoretical papers with a holistic approach to more concrete and simpler meanings in specific examples of participative and interpretative research in the specific research area and back to a greater number of theoretical papers based on complexity theory toward the end of the period. The same wavelike pattern is noticed in terms of methodological approaches: if theoretical and quantitative research could be related to semantic gravity, but qualitative research to semantic density, then semantic density continuously alternated with semantic gravity prohibiting the extremes of these codes. Describing interpretative research as one with semantic gravity in opposition to participative research as more practical research featuring semantic density, we can again observe a wave of change from greater gravity to greater density and back, when in the middle of sample period, the participative genre displaces the interpretative genre of research for a limited time.

The development of the research paradigm in the journal shows a rising need for solutions to research problems, conceptual controversies, and so on towards the end of the period under observation. Again, an awareness of the need for multi-methodology gradually builds with the development of DESD, as is well illustrated by the features of the research paradigms in JTEFS (2005–2014).

According to Knutsson (2013), studies in ESD should not try to avoid discussions on important political and ideological contradictions, and on this score, it was observed that the amount of criticism of normative explanations and the practice of ESD/SD (definitions, guidelines, etc.) rises toward the end of period analysed, and thereby, also toward the end of DESD. Fortunately, ESD research is no longer looked upon as something immune to flaws, theoretical and methodological contradictions and other issues that certainly signify the healthy development of this field.

As the analysis shows, all six processes necessary for effective ESD (see Tilbury, 2011), namely, collaboration, dialogue, "whole system" engagement, curriculum innovation, teaching/learning and active/participatory learning were to some extent integrated either in the content or methodological approaches of JTEFS papers. The limits of space do not allow these processes to be analysed in detail, although, it is clear that greater emphasis in the analysed period was put on collaboration, dialogue, curriculum innovation and teaching/learning. Furthermore, the research in TE for sustainability published in JTEFS can be characterized as transformative research, where the researcher is a partner exploring the world with people (Tilbury, 2011). To achieve inter- and multidisciplinarity or conduct large-scale comparative studies providing system-wide evidence is still not likely. The lack of such studies hinders the development of the research field and the trust of educational policymakers in the power of this specific branch of sustainability research.

In regard to the rigorousness of the academic contributions to JTEFS, in general the quality of the theoretical and implicational aspects of papers currently surpass the quality of the methodological descriptions; however, the study indicated the serious improvement of the quality of the papers toward the end of the sample period.

Limitations, Implications and Suggestions for Further Development

One of the limitations of this contribution is concealed in the topic, since a single paper does not have sufficient room to perform a full quantitative and qualitative analysis of the research paradigm in any journal – the number of possible approaches and tools for the analysis are huge. Initial plans for a deeper and more critical insight into the content of articles from the position of critical discourse analysis have to be postponed for later studies, although such a study would benefit from the joint interpretation grounded on bibliometric indicators and features of research paradigms provided in the present paper. Furthermore, one of the faults of this paper is the small number of cross-comparisons between the indicators used in the bibliometric analysis and the description of the research paradigms. In addition, deeper explorations of sample articles from JTEFS may provide suggestions in regard to high quality academic writing or a full example of some research theme. Besides, the subjective bias of authors in performing the coding of the content categories in the bibliometric analysis, as well as the interpretation of the findings should be acknowledged; the authors are closely connected with JTEFS as editors, reviewers and authors, and as members and founders of BBCC.

The exploration of JTEFS articles triggered a large number of ideas for further research; for example, to analyse the research paradigm of TE for sustainability, collecting articles from all journals publishing papers in this area and comparing the research paradigm used in JTEFS with that from other journals oriented toward sustainability education. The authors also saw the value in conducting critical discourse analysis on

the papers of JTEFS searching for discourses illustrating the dominance of any research paradigm and institutionalization, discrimination of indigenous/alternative approaches to education, culture and research, power of political indoctrination, ideology, normative definitions or the social power of global institutions and funding agencies, the control of topics and topic change and interests of institutions vs. interests of individuals. Another avenue for future research would be cross-comparisons between the indicators used in the bibliometric analysis and the description of research paradigms in JTEFS, making it possible to reveal some important relationships and regularities. A more detailed analysis of sample articles from JTEFS to provide suggestions for high quality academic writing and elaborated examples for some research themes could also be of interest for potential authors of the journal.

At the end of this extensive paper we would like to offer just a few important implications and suggestions for the further development of JTEFS and the field of research in TE for sustainability as such. What is important about disciplined inquiry is that its data, arguments and reasoning should be capable of withstanding careful scrutiny by another member of the scientific community (Shulman, 1997). Hence, the spread of research outcomes through peer-reviewed journal articles can be used as a way to facilitate disciplined inquiry in any scientific discipline. Throughout this paper we tried to provide not only the quantitative and qualitative outcomes of our analysis, but also some critical point of view toward our findings to enable the careful reader to make some inferences from this paper. However, so as to ensure stronger emphasis on several facets, the following are some implications and recommendations for the further development of JTEFS:

1) Deal with the diversity of research coming from different parts of the world and preserve its specific individuality while maintaining the high standards of academic writing;
2) Increase the amount of large-scale multi-national, multi-institutional and multi-disciplinary research;
3) Improve the overall quality of publications paying particular attention to the methodological dimensions of contributions;
4) Strengthen the Editorial Board of JTEFS by inviting several experts in the research methodology of educational research and teacher education;
5) Respond to the call from the UNESCO GAP (UNESCO, 2014) to focus research on issues not fully resolved or even increasing during DESD;
6) Decrease the number of papers only marginally connected with TE for sustainability.

In order to imagine the future of research into TE for sustainability as a field, we will refer to the *Roadmap for Implementing the GAP on ESD* (UNESCO, 2014). Although the research as such is not yet explicitly designated among the five priority areas of the Global Action Programme (GAP) in ESD (UNESCO, 2014), it can easily be used to benefit each of them: evidence-based research can help in decision-making and advancing policy at local and global levels, the transformation of learning and training environments is hardly possible without transformative research, and the integration of ESD into pre-service and in-service TE programmes can be evaluated both at the level of local action research and cross-comparative global research. More research is necessary on youth involvement in ESD activities and the integration of ESD programmes and perspectives

in the planning, and the decision-making processes of the community can be enabled through cooperation with university-based researchers while engaging in participative community research. Although, the normative UNESCO documents can serve as a valuable framework for research development, we should be aware that researchers need to preserve their academic autonomy to choose their research topics outside of normative prescriptions and to feel entitled to make a thorough analysis and engage in the constructive criticism of normative concepts, approaches and documents.

To Conclude

For such a small country as Latvia, which only recently began to install the traditions of peer-reviewed journals in the social sciences and educational research, it takes considerable effort to establish and financially support a journal like JTEFS that has become recognized as a fairly large international success.

The majority of the aims set for the development of JTEFS by its founders almost 10 years ago (Salīte & Pipere, 2007) have been successfully attained and even exceeded despite an economic crisis on a local and global scale, recent trends in the development of scientific research in terms of the denigration of the social sciences, education and the humanities, developmental trends and features of the social sciences and education. JTEFS is indexed in several publication databases, its content clearly focuses on different aspects of TE for sustainability, it has made some methodological advances and established thematic priorities, the scope of authors has evolved including representatives from different continents, countries, types of institutions and research backgrounds. As in good practice one should admit the successful instigation and development of the journal using networking and collaboration with BBCC affiliates, and the organisation of international conferences that determined the content and methodological focus of JTEFS. In particular, at the beginning of period under observation, the political, organisational and thematic orientation of the journal was inspired by ISE, whose members selflessly and passionately engaged in the establishment and further development of this research field notwithstanding different international and local challenges, unsustainable political and administrative changes characteristic of anthropocentrism (Steffen, Crutzen, & McNeill, 2007).

Much consideration, ideas and hard work were invested in JTEFS to build it to the level it is now. Its establishment is in some way a marvel; its growth cannot be denied. Although this study identifies some problems and controversies, we dare to admit that JTEFS has been a serious stakeholder for the development of research in TE for sustainability. This research area, albeit young, already demonstrates positive developmental trends and continues to evolve in harmony and interaction with other related fields of research. We hope that for the coming decade JTEFS will continue to be able to play its role as one of the most important driving forces in this research area on a global scale.

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Correspondence concerning this paper should be addressed to Prof. Dr. Anita Pipere, Institute of Humanities and Social Sciences, Daugavpils University, 1 Parādes Street 432, Daugavpils, LV 5401, Latvia. Email: anita.pipere@du.lv