Journal of the European Teacher Education Network
2019, Vol. 14, 39-49

Involving students in teachers` research - a way to improve the quality in higher education?

Heid Osnes, Hilde Nancy Skaug
Oslo Metropolitan University
Norway

Abstract
This article presents an example of research – teaching nexus with undergraduate students, in order to raise the quality in higher education. The students' evaluation of participating in research integrated with regular teaching provides helpful feedback to teachers so upcoming students can gain greater learning outcomes. The empirical basis consists of descriptive data from a questionnaire distributed in two classes of students in early childhood education at Oslo and Akershus University College of Applied Science (HiOA).[1]
Most studies of students as researchers have involved advanced students in university education, in general at master's level. Our study shows that first-year bachelor preschool teacher students may benefit from participating in research, also when quantitative research methods are used.

Key words: Research-teaching nexus, students as researchers, quantitative research, student evaluation

Introduction

A central theme in the context of higher education is how to improve the quality of education. Quality is a complex and multidimensional concept. However, in this context quality is about how different learning activities and working methods support the students` learning outcomes (Damsa et al., 2015). Increased quality in education is linked to the teachers` competence, and how the education is structured, but also how the students work with their subjects. In professional studies, students are educated for a specific profession; therefore, it will be important to cooperate with the field of practice to make sure that the education is vocational.

OECD (2012) describes various policies level on how to ensure good quality in higher education. One of the recommendations in first level is to link education and research closer together. This is often referred to as *research-based education*. OECD (2012) emphasizes that this is particularly important for undergraduate students, and this can be done by engaging students in carrying out research as part of the teaching. The next policy level deals with how students should be engaged in evaluating the education. This also applies to undergraduate students as they may have other perceptions and reactions than students at a higher level. In this article, we focus on these two recommendations.

There is no unified understanding of how research-based education should be conducted, but one way is to engage the students in the teachers' research and

[1] In 2018, HiOA became OsloMet – Oslo Metropolitan University.

development (R&D) activities, so-called *student-based research* (Ministry of Education and Research, 2013*)*. Research shows that students seem to learn the most when they participate in research-like activities (Healey, 2005; Jenkins, Breen, Lindsey & Brew, 2003; Justice et al., 2007), whereas traditional teaching methods such as lectures, may seem to make students passive (Young et al., 2009).

A major argument why students should get practical experience with R&D work is that they gain deeper insight into how research is carried out, become more independent and develop their analytical problem-solving, and develop skills in research and critical thinking (Brew, 2006; Healey, 2005; Justice et al., 2007; Nnadozi, Ishiyama & Chon, 2001). Research shows that undergraduate students are more satisfied and experience a greater degree of well-being when they participate in R&D work (Nnadozie et al., 2001;

Pascarella & Terenzini, 2005). There are fewer studies of student-based research on undergraduate students because students are most often involved in research at master's and doctoral level (Kyvik & Vågan, 2014). In Norway, students seem to a limited extent to be involved in research in professional studies, and there is not much research on how students can acquire experience in quantitative research methodology (Kyvik & Vågan, 2014).

This article presents a program for student-based research for part-time students who work in kindergartens. Three classes of students (280 students) participated in research work as part of their compulsory teaching in physical education during the first year of their bachelor program. In order to raise the quality of education, the institutions should carry out research on their own teaching and obtain students' evaluation of the curriculum (Damsa et al., 2015; OECD, 2012; Pascarella & Terenzini, 2005). Our study of student-based research with first-year bachelor students will hopefully contribute to new knowledge that can improve the quality of education.

The questions we discuss in this article are:

1. To what extent did the students experienced research-teaching nexus?

2. What learning outcomes did the students report after participating in the quantitative research project?

The research-teaching nexus - in an analytical perspective

Research-based education originated in Germany in the 18th century and is rooted in the tradition of Humboldt. According to this tradition, there should be a link between teaching and research (Jenkins & Healey, 2010). The American Ernest Boyer developed the principles for how education and research at all levels of higher education could be more closely linked. He led the work of the reputable report *Boyer Commission* (1998). This report received great international attention, partly due to the recommendations that also first-year students should participate in research. Boyer's report is the starting point for much of the work that has been done in large parts of the world in the field of research-based education. Several models for the research-teaching nexus have been developed. We have chosen Healey`s model (2005), which is clearly inspired by Boyer's ideas. This model is one of the first made, which furthermore has been the basis for developing other models (Visser-Wijnveen, 2015; Wuetherick & Turner, 2006). Healey's model is closely linked to our curriculum, fits well to our teaching practices and looks to meet many of the recommendations of the Boyer Commission.

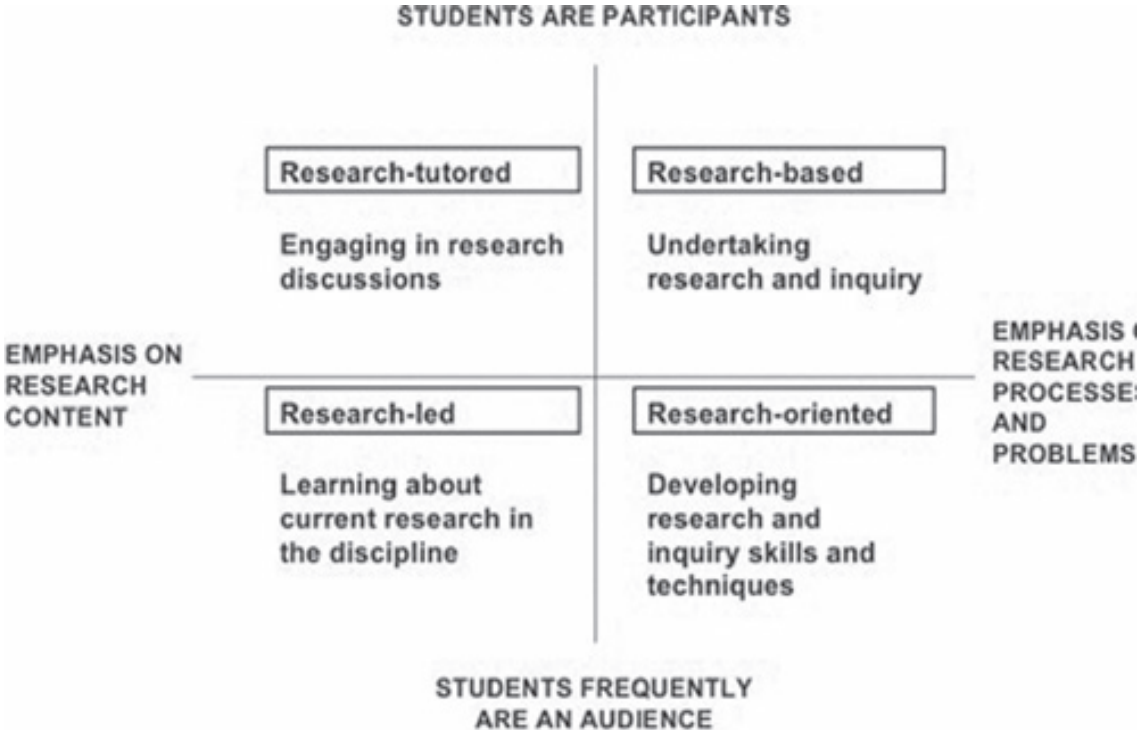

Figure 1. A model for the research-teaching nexus (adapted from Healey, 2005, figure 5.2)

The model shows four learning activities in research-teaching nexus. The left side of the vertical axis illustrates education and research related to academic topics, whereas the right side refers to research processes and methods. *Teacher-centered* learning activities are placed below the horizontal axis, whereas *student-centered* learning activities are above this axis. In teacher-centered learning activities, the students are audience and attend lectures where they learn about current research in the discipline (research-led) and/or they attend lectures on developing research skills and techniques (research-oriented). In student-centered learning activities, students are engaged in research discussions (research-tutored) and/or students conduct their own research work or participate in parts of a major research-based project. Student-oriented learning methods seem to contribute to in-depth learning and more advanced knowledge work compared to situations where the students are passive listeners (Damsa et al., 2015).

Description of our program for research-teaching nexus

We developed a program for research-teaching nexus according to Healey's model (2005), outlined in Figure 1. The students attended lectures and received practical teaching and tutoring, and they actively participated in our research. Through academic discussions and exchange of knowledge and experiences with fellow students and teachers, the students became a part of the academic community. The research question to be illuminated by the students and us is related to the Norwegian framework plan for the kindergarten's content and tasks in the field *Body, Movement, Food and Health* (Ministry of Education and Research, 2017). In this plan, it is stated that the kindergarten is intended to help children experience "well-being, joy and accomplishment with versatile movement experiences all year round" (Ministry of Education and Research, 2017, p.49). The purpose of our research is to reveal factors

that promote and inhibit children's physical activity play (PAP) indoors, in the playground and in the forest (X & X, 2015 a and b).

Table 1. Learning activities in chronological order, based on Healey's model for research-teaching nexus (2005).

Items - months	Learning activities	Based on Healey`s model
1: August - April	Lectures and practical teaching in physical education	-
2: September	Introduction of research questions	-
3: September - November	Lectures and presenting studies from children`s PAP	Research-led
4: September - November	Lectures on research methodology, research skills, techniques and ethical considerations	Research-oriented
5: September - November	Introduction, testing, improvement and final design of the observation form	Research-oriented and Research-based
6: November - February	Observation of children's physical activity play in kindergartens	Research-based
7: November	Training in the use of spreadsheet	Research-oriented
8: September - April	Individual and class tutoring	Research-tutored
9: May	Submission of written home exam	Research-based

Table 1 shows the learning activities of the physical education during the first year of study based on Healey's model (2005) for research-teaching nexus. Although Healey (2005) does not explicitly mention that students should receive a professional introduction to the research topic, we chose to give the students lectures and practical teaching in physical education during the first weeks (Table 1, item 1). We wanted the students to become familiar with the subject terminology of physical education in order to more easily understand the research question in a professional context. The research work was presented early in the semester (Table 1, item 2). Subsequently results from other surveys on children's PAP were presented (Table 1, item 3). Observation was used for data collection. In lectures on research methodology, the emphasis was on various aspects of observation as a method of collecting quantitative data as well as the observer role (Table 1, item 4). Ethical considerations related to the observation of children were also discussed.

We presented a draft of a structured observation form with closed and open response categories for collecting data. The students got experiences as observers while testing the form twice on groups of children in the gymnasium. The design of the observation form was discussed in the class and modified to a final observation form (Table 1, item 5) which they used to observe the children's PAP in the kindergarten (Table 1, item 6).

The students also received training in the use of spreadsheets and how to enter the observation data into an Excel file via the Fronter learning platform (Table 1, item 7). After they had entered the data into the spreadsheet, we transferred it to a statistical data analysis tool (IBM SPSS Statistics). The data was then analyzed and posted on Fronter in the form of tables and charts. The students received tutoring throughout the academic year, both individually and in class (Table 1, item 8).

In order for the students to get training in finding the connection between the research project and the teaching, the students used the data in their written home exam. Each student formulated a thesis question related to our common research question, and used

relevant data, other research findings and theory to elucidate their thesis questions (Table 1, item 9).

Methodological approach

Three classes participated in our research-based education program in the period 2010-2013. In order to investigate the students' experiences of the link between learning activities, research project and learning outcomes from participating in the research project, we prepared two questionnaires. Seventy students in the first class (2010-2011) responded to a paper-based questionnaire. This feedback is to be considered as a pilot study and were the basis for the preparation of the final questionnaire. We received feedback on which questions contributed to illuminate our research topics and which questions we had to modify. The results from the pilot study are not a part of the results discussed in this article.

We used an online database application, SiFRA, at HiOA to develop a digital questionnaire that was distributed to 210 students in two student groups from 2011-2012 and 2012-2013 respectively. The questionnaire was posted on Fronter in June after the students had received their final marks in physical education. After two reminders, we got 80 answers (38%). This feedback constitutes the basis of the results discussed in this article. Reasons for low answer response can be that students didn`t log into Fronter after terminated semester, or that they did not wanted to respond.

Because we have limited knowledge about the sample and the population, it is difficult to know to what extent the sample is representative of the population. Our research questions are related to what the students have learned from participating in the research work. We believe it is a strength, despite the low response rate, that the average grade of the final exam is C both in the sample and in the population. Thus, it is not likely that the dropout rate was higher among the most skilled than the most disadvantaged students. In the sample 81% were women and 19% men, while the population consisted of 76% women and 24% men. The vast majority of students in the sample had experience from part-time work in kindergartens and there is no reason to believe that this was not the case for the students in the population.

Based on the information we have about the sample, compared to the population, we have no indication that the low response rate was systematic. Due to limited knowledge about the sample, it is uncertain to what extent, the data can be applied to the entire student group participating in the research. The questions were designed on the basis of the pilot study, other comparable studies, public documents and studies on research-based education. The questionnaire consisted of 19 questions. In this article, we discuss only two of the questions the students responded to. The students were asked to decide to what extent they agreed or disagreed with statements about the relationship between teaching and research work. In the assessment of learning outcomes, students were asked to choose the statements they could relate to the most. At the end of the questionnaire, the students could give general comments on the teaching in the physical education course, and how they experienced participating in the research work.

In the analysis of the data, we used IBM SPSS Statistics. The single variables in the data were analyzed using frequency tables and descriptive statistics to show how the units were distributed along the variables. The results are presented in both frequency and percentage. Univariate frequency distributions were made, as bivariate analyses were not available. In the presentation of the data, the response options *highly*

agree and *agree* are emerged just like *strongly disagree* and *disagree,* in order to provide a better picture of the extent to which statements the students recognized.

Ethical considerations

All the students were invited to participate in the evaluation. Research ethics guidelines on voluntariness and anonymity were adhered. The students were informed that their evaluations might be presented at conferences and in professional articles.

Method Criticism

Despite the low response rate, we believe that we have sufficient knowledge about the students who answered the questionnaire, to be able to draw conclusions about all the students participating in the project. It may be a challenge that the students' evaluations are based solely on their assessments of their own competence. Furthermore, no measurements were made of the students' competence of self-assessment in research knowledge prior to the start of the project. Therefore, we cannot present a comparison of the students` level of knowledge before and after the academic year in order to strengthen the results of the survey. Regarding learning outcomes, the students were asked to tick the statements with which they agreed the most. We do not know if other statements could have described the students learning outcome better, or to what extent they agreed with the statements. We did not ask the students how they experienced working closely with the teachers in the research work. In the comments at the end of the questionnaire, several students wrote that the teachers were enthusiastic and motivating, something which could have contributed to a more positive experience of the collaborative research than if the teachers had been more skeptical to involving students in the research. Despite some weaknesses in the study, we believe that student feedback clearly shows how the students experienced participating in different learning activities, as outlined by Healey (2005) in his research-teaching nexus.

Results

The results are presented in two parts. The first part deals with the extent to which the students experienced a link between the education and the research work. In the second part, we present what the students believe they have learned from participating in the research.

Connection between teaching and research

Research-based education can be achieved by linking education and research, for example through various forms of student-based research, which Healey (2005) denotes as *research-tutored* and *research-based*. Previous studies do not provide unequivocal answers to what extent the students experienced a connection between the education and the research they participated in (Healey, Jordan, Pell & Short, 2010; Zamorski, 2010).

Table 2. Statement: I have seen a clear connection between lectures, tutoring and research work.

	Frequency	Percentage
Strongly agree or agree	77	96
Disagree	2	3
Do not know	1	1
Total	80	100

Table 2 shows that almost all the students (96%) believed that there was a connection between lectures (research-led and research-oriented), tutoring (research-tutored) and the research work (research-based). Only three percent disagreed with the statement that there was a high degree of connection between these learning activities.

Learning outcomes of participating in research

Several studies show that students experience greater learning outcomes when they are involved in research (Jenkins et al., 2003; Justice et al., 2007). We wanted feedback on what the students learned about quantitative methodology through participating in the research. We asked them to assess 15 statements about learning outcomes and check the five statements they could relate to the most.

Table 3. Students' learning outcomes from participating in research.

Statements on learning outcomes	**Frequency**	**Percentage**
Learned about observation as a method	82	83
Learned about sources of error in research	57	58
Learned that observation is never objective	54	55
Learned that results from observations do not always match my own expectations	51	52
Learned that data interpretation is difficult	49	49
Learned about what to consider when using observation as a method of data collection	47	47
Learned to be critical of research	44	44
Learned that observing requires full concentration	38	38
Gained insight into what research is	36	36
Learned to create tables and charts	30	30
Learned how important it is to put emotions aside when observing children	29	29
Learned how to process data from observation	24	24
Learned to use Excel	19	19
I understand better what research work implies	17	17
Learned to read tables	15	15

Table 3 shows which statements about learning outcomes that the students related to the most. We find a wide large variation in the response from the students. Most students believed that they learned about observation as a method (83%) and that research results may be associated with sources of error (58%). Less than half the students (44%) responded that they had learned to be critical of research and studies in general. Nearly half of the students found it difficult to interpret data. Fewer students stated that they

had acquired skills in quantitative research; 30% reported that they had learned to create tables and charts, 24% that they had learned about data processing, 19% had learned to use spreadsheets and 15% had learned to interpret tables.

Discussion

First, we discuss the students' experience of the research-teaching nexus, then we highlight the students' learning outcomes by being co-researchers.

Connection between research and teaching

Almost all the students responded that they had seen a strong connection between the lectures, the tutoring and the research work they had participated in (Table 2). This link is often described as research-based education (Ministry of Education and Research, 2013). It may be surprising that first-year students experienced a clear link between learning activities, as other studies show that students do not see this connection until they have progressed further in their education (Zamorski, 2010). We believe that this may be due to how the education and the research work were interrelated and to the fact that we used all the four methods that Healey (2005) outlines for the research-teaching nexus (Damsa et al., 2015). The fact that the learning activities were used in the same academic year, and not over a three-year bachelor's course, may also have helped the students to recognize subjects from lectures and tutoring when working on the research project.

Another interpretation may be that the students experienced that there was a connection to the learning activities because the data they collected were used in their exam assignment. Each of the examination papers was in some way a smaller research report where the students learned that theory, method and data are all necessary in order to discuss their thesis question. One student wrote under general comments; *I found the process exciting and wanted to participate in more research-related tasks*. This may indicate that the students felt they were real participants in our joint research work, as opposed to results revealed by other studies on student-based research where students found that they were spectators and not actively involved in the teachers' research (Zamorski, 2010).

We are not familiar with the existence of other student evaluations where one has studied the importance of tutoring (research-tutored) in student-based research. Our experience is that regular tutoring became a natural link between the lectures and the research work (Boyer, 1998). We expected that many of our students had little experience and knowledge about research before they became involved in the research work. A student confirmed this and wrote: *I am a new student and research is unknown for me.*

Learning outcomes of participating in research

We also examined what the students learned from participating in the research, something Healey (2005) calls *research-based*. Previous studies have shown that students learn more about scientific methods and become more independent in research-like activities when they participate in research (Brew, 2006; Pascarella & Terenzini, 2005). In our joint research work, the students used quantitative methods for collecting

and analyzing data, and we wanted to investigate to what extent our students had learned about quantitative methodology.

We used observation when collecting data. 83% of our students responded that they had learned about this method (Table 3) which confirm earlier studies stating that participating in research contributes to the students' learning process (Justice et al., 2007). 58% responded that they had learned about sources of error in research, and almost half of the students believed that they had acquired greater ability for independent and critical thinking. Increased ability to evaluate the credibility of sources and to accept that research data can be interpreted in different ways may be developed through exercise and in-depth learning.

Analysis and interpretation of data is central to all research. Quantitative research includes numbers and statistics that need to be interpreted, as they are not self-explanatory. Half of our students said that interpretation of data was difficult (Table 3). We do not believe that the explanation of this is that the students were unable to apply the data to a kindergarten context, as many of the students had long experience in kindergarten work. A more likely explanation is that many students had poor numerical literacy i.e. ability to use and understand mathematics. The fact that only 15% of the students stated that they had learned how to interpret tables, reinforces this assumption (Table 3).

We do not know much about the general level of knowledge of our students, except that the average grade in physical education is a C, and that the admission requirements of kindergarten education are lower than for comparable professional educations (NOKUT, 2010). Perhaps we had too high expectations regarding the students' mathematical knowledge. In order to assess the students' prior knowledge before the research work began, we could have systematically surveyed their competence and provided tutoring in order to close the knowledge gaps. Another option would have been to change the research plan so that it was more adapted to the students' competence. The tutoring was spent on discussions and reflections on what the results might imply in practice. However, when the students responded that they find it difficult to analyze and interpret the data, it may indicate that we were unable to adapt the tutoring to each individual student. It was time-consuming and challenging for two teachers to follow up so many students with different levels of understanding of numbers and statistics. Another reason may be that the academically weakest students did not show up for tutoring, as this was not mandatory. If we ignore observation as a method of collecting data, it appears that the students to a limited extent had acquired the necessary quantitative research skills. Nursing students also stated that it was demanding to understand and use quantitative research methods (Grønvik et al., 2014). They felt that lack of foreknowledge contributed to low motivation for learning about quantitative methods and statistics. It can be challenging to categorize the students' learning outcomes from participating in research work. The students apparently learned most about observation as a method and less about how to use quantitative research skills in practice. To fully participate in research, students must have the knowledge and skills needed for the research. A reason why some teachers are skeptical to involving students in their research may be that students lack sufficient research knowledge and experience (Brew, 2006; Zamorski, 2010). Consequently, students quite often do not get the opportunity to participate in research until they reach masters or doctoral level. Because the teaching in physical education in this period was clearly research - based there is reason to believe that this may have improved the quality of higher education (OECD, 2012). The students` feedback has provided useful information on how we can further develop our teaching.

Summary

In the article, we have presented first year bachelor students` evaluation of the education as recommended by OECD (2012) to ensure good quality in higher education. We appear to succeed with linking teaching and research, which is one recommendation in OECD`s (2012) first policy level. Most students experienced a clear connection between research work, lectures and tutoring. The proportion of students who experienced this connection was so great that, despite the low response rate to the questionnaire, we find it reasonable to assume that this trend would observed also if more students had answered. Possible explanations for this finding may be the linked learning activities, and that the students used and discussed data they collected earlier in their written home exam.

This study shows that it is possible to implement good student-based research programs, even for large groups with first-year students. On the other hand, the follow-up of individual students could be better if the student group was smaller. The students expressed they learned most about observation as a method of quantitative research, and that research may have weaknesses that require research reports to be read critically. A smaller proportion of the students stated that they had acquired research-related skills, such as analyzing and interpreting quantitative data. The students' answers to the question of learning outcomes were somewhat less clear than to the question of the relationship between teaching, tutoring and research. We do not know for sure if the tendency would have been more apparent with a larger response rate in the evaluation. Although it was possible to give additional comments in the questionnaire, interviews of students could provide more knowledge of how teaching could give the students better learning outcomes. An obvious weakness in the teaching plan was that many students had low numerical literacy when the project started. Later we will make sure that the students have the competence that is needed in the research they are to participate in.

References

Boyer Commission (1998). *Reinventing undergraduate education: A blueprint for America's universities.* NY: The Carnegie Foundation for the Advancement of Teaching.

Brew, A. (2006). *Research and teaching: Beyond the divide*. London: Palgrave Macmillan

Damşa, C, T., de Lange, M., Elken, R., Esterhazy, T., Fossland, N., Frølich, E., …. Aamodt,P.O. (2015). *Quality in Norwegian Higher Education: A review of research on aspects affecting student learning*. (NIFU-Rapport, 2015: 24). Retrieved from https://www.nifu.no/publications/1288405/

Grønvik, C. K. U., Julnes, S. G. & Ødegård, A. (2014). En kvalitativ studie av sykepleiestudenters opplevelser av nye læringsaktiviteter i kritisk vurdering av kvantitative forskningsartikler. *Nordisk Tidsskrift for Helseforskning*, *10* (2), 91–105. https://doi.org/10.7557/14.3325

Healey, M. (2005). Linking Research and Teaching: Exploring Disciplinary Spaces and the Role of Inquiry-based Learning. I R. Barnett (Ed.), *Reshaping the university: new relationships between Research, Scholarship and Teaching* (67-78). Maidenhead: Open University Press.

Healey, M., Jordan, F., Pell, B. & Short, C. (2010). The research-teaching nexus: a case study of students'awareness, experiences and perceptions of research. *Innovations in Education and Teaching International*, *47* (2), 235-246.https://doi.org/10.1080/14703291003718968

Jenkins, A., Breen, R. & Lindsay, R. with Brew, A. (2003). *Reshaping Teaching in Higher Education: Linking Teaching with Research.* London: Routledge/SEDA.

Jenkins, A. & Healey, M. (2010). Undergraduate Research and International Initiatives to Link Teaching and Research. *Council on Undergraduate Research, 30* (3), 36-42. Retrieved from https://www.cur.org/assets/1/23/303-36-42.pdf

Justice, C., Rice, J., Warry, W., Inglis, S., Miller, S.& Sammon, S. (2007). Inquiry in Higher Education: Reflections and Directions on Course Design and Teaching Methods. *Innovative Higher Education, 31*(4), 201-214. https://doi.org/10.1007/s10755-006-9021-9

Kyvik, S. & Vågan, A. (2014). *Forskningsbasert utdanning?* Oslo: Abstrakt Forlag AS.

Ministry of Education and Research (2013). *Long-term perspectives – knowledge provides opportunity* (Meld. St. 18 2012–2013). Retrieved from https://www.regjeringen.no/en/dokumenter/meld.-st.-18-2012-2013/id716040/

Ministry of Education and Research (2017). *Framework plan for the content and tasks of kindergartens.* Retrieved from https://www.udir.no/in-english/

Nnadozie, E., Ishiyama, J. & Chon, J. (2001). Undergraduate research internships and graduate school success. *Journal of College Student Development*, *42* (2), 145-156. Retrieved from https://search-proquest com.ezproxy.hioa.no/docview/195176102?accountid=26439&rfr_id=info%3Axri%2Fsid %3Aprim0

NOKUT (2010). *Evaluering av førskolelærerutdanningen. Del 1.* (NOKUT, Hovedrapport 2010). Retrieved from https://www.nokut.no/contentassets/40568ec86aab411ba43c5a880ae339b5/hovedrapport_flueva.pdf

OECD (2012). *Fostering Quality Teaching in Higher Education: Policies and Practices.* (IMHE. Institutional Management in Higher Education). Retrieved from https://www.oecd.org/edu/imhe/QT%20policies%20and%20practices.pdf

Pascarella, E. T. & Terenzini, P. T. (2005). *How college affect students: A third decade of research (2nd Ed)*. San Francisco, CA: Jossey-Bass

Visser-Wijnveen, G.J. (2015, December). A knowledge model of the research-teaching nexus. Paper presented at the annual conference of the Society for Research into Higher Education, Newport, UK

Wuetherick, B. & Turner, N. (2006). Difficulties abound: conceptualizing and modeling research-based teaching and learning. Paper presented at the 2nd Annual Canadian Summit on the Integration of Research, Teaching and Learning. Edmonton, Canada

Zamorski, B. (2010). Research – led Teaching and Learning in Higher Education: A case. *Teaching in Higher Education, 7* (4), 411 – 427. https://doi.org/10.1080/135625102760553919