Historical Characteristics of Education Portfolio Research from Keywords of Research Papers in ERIC

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Abstract: This paper is a report on the analysis of papers with keywords about portfolios in the ERIC Collection to make clear the history of educational portfolio research. Portfolios are regarded as an assessment tools for students in college in all years. As a result of the analysis, we have been able to classify portfolio research since 1975 into five stages: predawn, growth, peak, decrease and stabilization. In the early 1990s, portfolios changed greatly, as they went through digitalization, diversification and standardization. In the late 1990s, portfolios were scaled up from individuals to associations and organizations. More recently, an equilibrium has been reached between the appearance frequencies of the keywords "Portfolio Assessment" and "Portfolios (Background Materials)" and portfolios are used in the practical assessment of problem solving.

Introduction

According to the Education Resources Information Center (ERIC) sponsored by the Institute of Education Sciences (IES) of the U.S. Department of Education, educational portfolio research has been carried out since 1975. A portfolio is a purposeful collection of student work that exhibits to the student and/or to others the student's efforts, progress, or achievement in a given area. This collection must include student participation in the selection of portfolio content, the criteria for selection, the criteria for judging merit and evidence of the student's self reflection (Meyer and Angello, 1990).

In the 1970's teachers were primarily evaluated by written tests. However people thought that written test were not enough to evaluate teacher performance, and classroom observation began to be used in the 1980s. The concept of "teaching portfolio" was used first under the auspices of the Canadian Association of University Teachers in 1986, and in the 1990s, "portfolio assessment" focused on qualitative evaluation methods to evaluate what could not be ascertained by traditional written test, to increase accountability in research and educational results for parents of university student's in the US (Sugimoto, 1997, Tsuchimochi, 2006). Portfolio assessment is a specific from of performance assessment or authentic assessment that attempts to measure higher level thinking skills (Miller and Legg, 1993).

In the early 1990s, there were only paper portfolios. Recently, however, with the development of ICT (Information and Communication Technology) there are electronic and web-based portfolios. These portfolios are used as evaluation tools of e-Learning, for example Mahara with Moodle or OSP with Sakai. In this way, portfolio assessment has changed to a wide variety of contents and formats with the development of science and technology and education research. Researcher's and grader's ideas about portfolio assessment have become diverse and portfolio assessment is now complex. It has been very difficult to compare grades vertically over time, or horizontally between universities in educational practice in which portfolio assessment is used.

We therefore need to clarify the characteristics of portfolio assessment used in previous research about portfolios to get a general overview of this complicated situation and to make vertical and horizontal comparisons. The purpose of this paper is to analyze the keywords of all papers in ERIC using the text-mining method and identify the characteristics of each period of portfolio research.

Methodology

First of all, we accessed ERIC (http://www.eric.ed.gov/). ERIC provides unlimited access to more than 1.3 million bibliographic records of journal articles and other education-related materials, with hundreds of new records added multiple times per week. If available, links to full text are included. Within the ERIC Collection, we are able to find records for journal articles, books, research syntheses, conference papers, technical reports, policy papers and other education-related materials (ERIC, 2010).

Next, we picked out all papers including "Portfolio Assessment" or "Portfolios (Background Materials)" in the keywords in the ERIC Collection and classified the papers in five-year periods. We created categories of keyword for each five-year period using text-mining method with the software IBM SPSS Text Analysis for Surveys. This software registers synonyms and antonyms in an internal dictionary, and this software is able to classify words by lexical relationships using examples from dictionary data.

Portfolio Papers in ERIC

Figure 1 shows graphically the number of papers and appearance frequency of the keywords in all papers including "Portfolio Assessment" or "Portfolios (Background Materials)" in the keywords in the ERIC Collection. The bar chart shows the number of papers and the line charts show the appearance frequency of each keyword. In addition, there are duplicate keywords in some papers because appearance frequency of keywords was counted distinctly.

Number of Papers

The oldest paper mentioning portfolios in the ERIC Collection were in 1975, and up to 2009, there have been 3,733 papers. The number of papers about portfolios increased sharply since 1990 and exceeded one hundred per annum in 1992. From the early 1990s onwards, we found that attention began to be paid to portfolio assessment. They exceeded two hundred per year and reached the greatest number in 1996. However they decreased sharply in 1999 and fell to below a hundred in 2003. There have been over a hundred papers per annum again since 2004, and kept over 150 papers recently. We can identify five periods: the predawn of portfolio research from 1975 to 1989; a stage of growth from 1990 to 1993; a peak in portfolio research from 1994 to 1997; a period of decrease from 1998 to 2003; and a period of stabilization since 2004.

Appearance Frequency of Keywords

For the first sixteen years, there was no keyword "Portfolio Assessment" but only "Portfolios (Background Materials)" (Figure 1 and Table 1). The keyword "Portfolio Assessment" has began to appear in 1991 and has increased sharply since 1994. The keyword "Portfolios (Background Materials)" appeared more
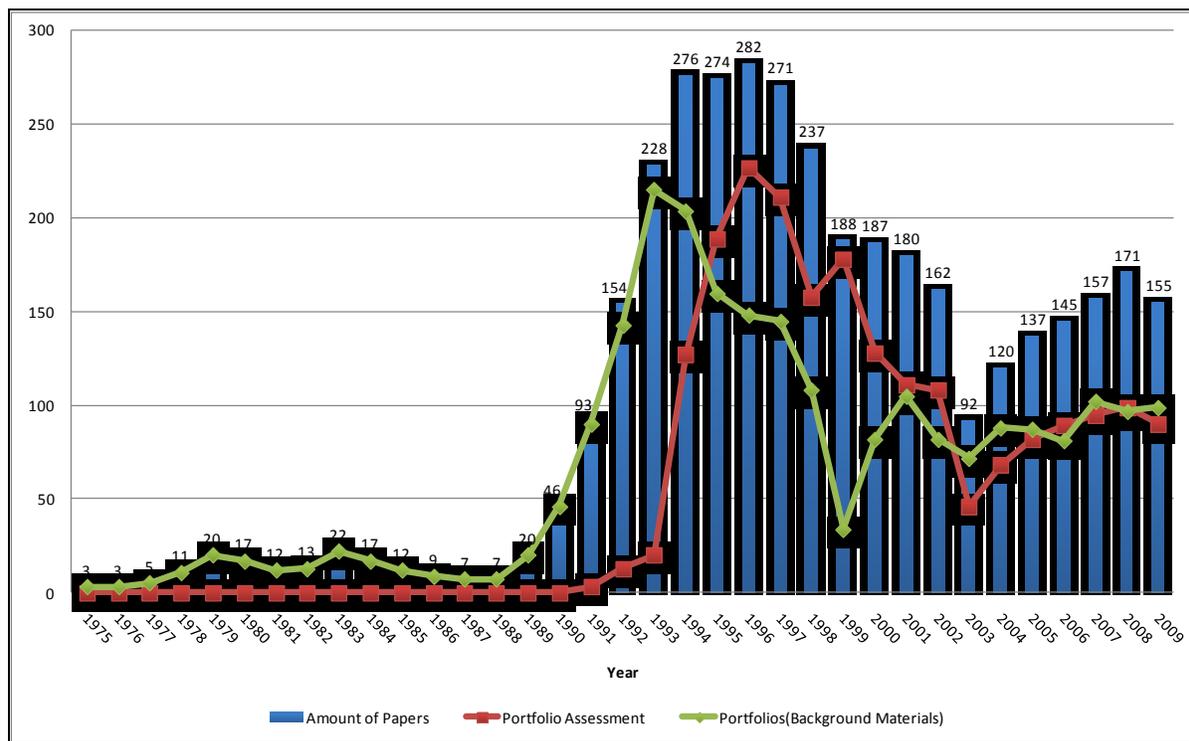
Figure 1: Papers in ERIC with Keywords about Portfolios

Table 1: Appearance Frequency of Keywords

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Portfolio Assessment	0	0	0	0	0	0	0	0	0	0	0	0
Portfolios (Background Materials)	3	3	5	11	20	17	12	13	22	17	12	9
Both*	0	0	0	0	0	0	0	0	0	0	0	0
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Portfolio Assessment	0	0	0	0	3	13	20	127	189	227	211	158
Portfolios (Background Materials)	7	7	20	46	90	143	215	204	160	148	145	108
Both*	0	0	0	0	0	2	7	55	75	93	85	29
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	**SUM**
Portfolio Assessment	178	128	111	108	46	68	82	89	95	99	90	**2042**
Portfolios (Background Materials)	34	82	105	82	72	88	87	81	102	97	99	**2366**
Both*	24	23	36	28	26	36	32	25	40	25	34	**675**

* "Both" indicates both "Portfolio Assessment" and "Portfolios (Background Materials)".

often than "Portfolio Assessment" from 1975 to 1994, but they were inverted from 1995 to 2002. Since 2003, their appearance frequencies have been about the same.

Categories of Keyword

In order to clarify the characteristics of keywords, we classified all papers about portfolio roughly into five-year periods. The year 1975 is included in the group of 1976-1980 and the last group is sets up as 2006-2009. Table 2 and Table 3 show appearance frequencies of keywords in each group. In Table 2, quote-unquote category "()" is used to include plural or ing-form, and square bracket "[]" show the inclusion of in synonyms. In addition, quote-unquote number "()" in Table 3 show the appearance frequency of each keyword.

After classifying all papers, we created categories of keywords with the text-mining software IBM SPSS Text Analysis for Surveys. The keywords "Portfolio Assessment" and "Portfolios (Background Materials)" were excluded because these keywords are in all papers and an obstacle to analysis. Categories of keywords are shown in Table 2 and Table 3, and the following points are noted:

- Portfolios are regarded as an assessment tool for students in college because the categories "assessment", "college(s)", "education" and "student(s)" appear in all years. Portfolios are used for assessment of occupational skills and accountability of college because we frequently find "occupation(s)", "development" and "skills", and "plan(ning)", "administrator(s)", "papers", "writing" and "cognitive processes".
- Portfolios have been digitized and became diversified since the early 1990s because we find "attitude", "computer" and "courses" since 1991-1995.
- Although portfolios were for teachers since 1975, they changed from "teacher" to "pedagog" from 1991 and perhaps focused on elementary education teachers in particular. The keyword "pedagog" suggests someone who educates young people. The change from "teacher(s)" in 1975-1990 to "pedagog" in 1991-2009 may have been a change in SPSS definitions.
- Portfolios showed experiences for placement at first because there were "adults", "experience", "objectives", "placement" and "tests" in 1975-1980. After that, they showed task of associations and organizations after 1991-1995 because there were "associations" and "departments" in 1991-2000 and "organiz[s]ation(s)" and "task" in 2001-2009.
- There is a possibility that portfolios have been used as an information delivery tool because there are "info" after 1981-1985 and "information" after 1996-2000. In addition, the category "info" is included in keywords about information contents which are program, curriculum and so on, and the category "information" is included in keywords about the use of information which is utilization, retrieval and so on.
- Portfolio research has been standardized in a way because some of the early categories decreased greatly after 1991-1995 in Table 3.
- There is a possibility that portfolios have been used as practical assessment of problem solving after 1991-1995 because there are "abstract thought" in 1991-1995, "problem solving" in 1996-2000, "public speaking" in 2001-2005, "gatherings", "reasoning" and "speech" in 2006-2009.

Conclusions

In order to clarify the history portfolio research, we picked out all papers including "Portfolio Assessment" or "Portfolios (Background Materials)" in their keywords in the ERIC Collection and created categories of keywords in every five years using text-mining method. As a result, there were 3733 papers by 2009 and we found that portfolios were regarded as the assessment tool for students in college in all years. The results suggest the following stages.

A) Predawn of Portfolio Research (1975-1989)

"Portfolios (Background Materials)" was the only keyword. Portfolios showed experiences of adults for placement and coaching records of teachers. In addition, portfolios began to be used as an information delivery tool and for publishing information.

B) A Stage of Growth (1990-1993)

The keyword "Portfolio Assessment" began to appear since 1991. Digitalization began, and portfolios became diversified. Portfolios for teachers changed from "teacher" to "pedagog" and began to focus on elementary education teachers. They were also used to assess associations and departments not only individuals. In addition, research was standardized to an extent.

C) Portfolio Research's Peak (1994-1997)

The greatest number of papers about portfolios was 282 in 1996. The keyword "Portfolio Assessment" exceeded "Portfolios (Background Materials)" from 1995. Portfolios began to be published in consideration of the use of information in addition to the content of information.

Table 2: Keywords of Each Period (in Multi-Periods)

	1975-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2009	Freq.
education	48	67	82	970	1037	561	434	3199
student(s)	26	38	57	663	656	298	289	2027
assessment	26	33	48	405	296	98	116	1022
college(s)	16	13	11	83	90	44	60	317
info		22	29	328	395	10	3	787
development		12	8	111	187	110	111	539
skills		16	9	131	152	63	66	437
occupation(s)	30	15		50	87	47	34	263
cognitive processes			23	657	691	383	298	2052
plan(ning)	10	2			30	160	208	410
writing		4		156	146	57	46	409
papers		11	9	79	116	34		249
administrator(s)		4	4	36	53	12		109
pedagog				536	685	384	336	1941
investigation(s)			21	325		231	223	800
educational institution		6		223	270		132	631
computer				57	111	119	134	421
courses				48	90	42	54	234
communication	4			35		24	39	102
attitude				20	22	19	32	93
groups			2	21		21	39	83
mental object				272	223	165		660
language				68	99	47		214
group action				90	80	32		202
teacher(s)	8	22	28					58
information					17	17	12	46
records	2	8	4					14
studies	10						324	334
organiz[s]ation(s)						182	42	224
measurement				87			53	140
associations				5	77			82
departments				29	21			50
task						13	26	39
authority			2		35			37
experience	18	17						35
mercantilism					26	8		34
tests	13	8						21
objectives	7	12						19
promotion	5						11	16
placement	9	4						13
adults	8	5						13
gymnasium	4		7					11
auditory communication				5		2		7

Table 3: Keywords of Each Period (in Single Period)

Year	Keywords
1975-1980	degree programs(7), guides(6), instruction(6), materials(5), tenure(5), spatial property(3), examination(3), counselor(3), models(3), selection(3), volunteers(3), cost(2), day care(1)
1981-1985	statement(16), decision making(14), subject(13), recruitment(6), admission(4), business(3), scientific discipline(3), processing(2), professional person(2), laurels(2)
1986-1990	verbal creation(22), individuals(16), achievement(11), interviews(11), credits(9), looking(8), physical process(7), grade(7), natural action(5), qualifications(5), mathematics(3), cooperation(2), techniques(2), french(1)
1991-1995	evidence(40), abstract thought(34), juvenile person(28)
1996-2000	attempt(180), problem solving(66), publicity(21), work(16)
2001-2005	room(33), public speaking(21)
2006-2009	reasoning(110), methods(28), systems(25) , gatherings(16), speech(10)

D) A Period of Decrease (1998-2003)

The number of papers about portfolios was a third of the greatest number, and the keyword "Portfolios (Background Materials)" became more than "Portfolio Assessment" again in 2003. Portfolios have shown tasks of organizations on the development from associations and departments.

E) A Period of Stabilization (2004-)

Equilibrium between appearance frequencies of both keywords "Portfolio Assessment" and "Portfolios (Background Materials)" has been reached. Portfolios are used in the practical assessment of problem solving since 1991-1995, and a recent hot topic is the evaluation of speech being a part of problem solving ability.

In the future, we are going to analyze all papers about portfolio in ERIC Collection with factor analysis to make clear the categories of keywords and research papers over every five-year period.

Acknowledgement

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