

Knowledge Diffusion in Vocational Education and Training: A Scientometric Study

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Abstract

This study is an attempt to highlight the knowledge diffusion in the form of publications in Vocational Education and Training. The efforts have been made to explore the periodic growth and development of literature. To make the quantitative analysis by way of evaluating different factors of knowledge diffusion (KD) and dissemination, the output based on Core Collection of the Web of Science (WoS) database is examined. A total of 3703 documents were published during the period 2006-2015 in VET domain, which received 26940 citations. The average number of documents published per year is 370.30. The publications peaked in 2015 with the total 671 publications. The highest number of publications was from the England with 1196 (32.29%) publications followed by the USA with 1160 (31.32%), Germany with 287 (7.75%) publications. The Study has identified 25 most productive journals. The h-index is 55 in the field of VET. The study has reported 13 highly cited papers during the period having citation ≥ 100 forming the citations classic in the VET. Thus, constitutes the core of the subject by attaining 9.13% of total citations received during the period. The study finds that during the period of study 7.27 average citations per item received by the publications.

Keywords: Vocational Education, Vocational Training, Citations, Co-Authorship, Productivity, Publications, Scientometric

INTRODUCTION

The vocational education and training sector is emerging prominently in response to the global challenges of fighting poverty, unemployment, and sustainable development. Currently, the demand for the skilled workforce is ever increasing for increased productivity and better economy. Thus, as of now, the future perspectives of VET are seemed to be bright. As a result, the present focus of the education has shifted to make the high school children and university graduates ready for the jobs. This demands imparting skill and training to them, however, the rapidly changing needs of the skills market has increased complexity. The following are the three major challenges being faced by the VET professional's across the globe:

- Ever changing learners requirements
- Increased industry competition
- Weaker demand from industry

The situation becomes more complex when the cost of VET becomes more expensive and complex day to day, therefore, it is very tough to attract and retain the students those who have discontinued their studies especially those have lower socioeconomic status, are from rural or remote areas, disabled, and comes from the diverse culture and linguistically background. Hence, retaining the students is a big challenge. One in five students in the US and one in seven students in Canada do not make it into the second year of their college courses. In the Indian context as the existing educational infrastructures are not seems to be sufficient to meet the demand of skilled manpower. To solve the problem National Skill Development Agency (NSDA) have been established under the Ministry of Ministry of Skill Development And Entrepreneurship, Government of India. This will help in cultivation skilled manpower. The core focus of the ministry is to have the solution to the problem of school dropouts at the level of primary, secondary and senior level. This will help in imparting the skills with general to the dropouts.

This is notable that the highly skilled people are in acute demand. Therefore, their movement between the countries is very frequent. At an estimate, about 193 million migrant workers moved to the countries for employment during 2010 and will continue to rise in future also. The migrant worker requires re-skilling and further training as per the norms of the migrant nation. South Asian developing countries like India could be referred as a young nation because the millions population of youth being added every year. We only have provision for vocational education and training for lesser people in the country, knowing the fact that whereas many persons enter the labour market every year. About 90% of employment opportunities require vocational training and skills, something

that which is not taught in schools and colleges along with general education system. To become at par with the level of international education the world's two largest labor markets China and India have begun to invest heavily in significantly improving their training programmes and skills for capacity building of workforce just like the US, European Union and other leading training providers (Elford, 2011). The present study makes a Scientometric analysis of publications in the area of VET, published during 2006-2015 and indexed by WoS Core Collection Database.

REVIEW OF LITERATURE

Ozel (2012) had carried an empirical research study to understand the knowledge generation and the knowledge movement through collective social interaction focusing on (i) nature (ii) chain (iii) modes of knowledge diffusion while exploring process of knowledge transfer and combined structure by implying the research methods of meta-network analysis to study the diffusion of knowledge. Whereas Ben-David and Lowy (2000) used the standard neoclassical framework with some modifications study the growth model of knowledge accumulation. Moser and Nat (2009) have the view that the study of knowledge has emerged under the influence of Plato and Aristotle in ancient Greece. Plato in his view as the "Theaetetus" immortalised knowledge as consists of justified and true belief also called "the traditional analysis of knowledge". Therefore human knowledge can also be categorised into various categories like empirical and non-empirical description knowledge, knowledge by acquaintances. Further notable work by Nonaka and Krogh (2009) explained the controversy and advancement in the theory of organisation of knowledge creation, the method of transforming implicit knowledge to explicit forms. They have the emphasis on the knowledge helical that explains the modification of indirect (tacit) knowledge into direct knowledge. Glanzel (2012) in his paper explains the application of the bibliometric method for analysis of selected social science area. Van Raan (1997) aims to study the "measuring science" via bibliometric analysis. The study was conducted after reviewing the progress in the quantitative study of science during early 1970's. This analysis includes the perspectives like collaboration, interdisciplinary relation and knowledge users.

OBJECTIVES

Following are the core objectives of the study

- 1) To document the domain-wise distribution of publication in VET.
- 2) To explore the growth of publications and citation impact in VET.
- 3) To find out geographic distribution of publications in VET and to examine their citation impact.

- 4) To identify most prolific authors and institutions.
- 5) To find out the highly preferred journals and in VET.
- 6) To find out the highly cited publication in VET.

MATERIALS AND METHODS

Web of Science Core Collection database subscribed by the Tata Institute of Social Sciences, Mumbai, was used for retrieving the data on VET for the period of ten years using the search term "Vocational education* OR Vocational training*" in the 'topic' field. The OR search operator is used for retrieving the maximum number of records for analysis. Records pertaining to the VET were retrieved only from 2006 to 2015. A total of 3703 publications were published during the period and 26940 citations received by these publications. The data analysis was performed according to the objectives of the study. The MS Excel package was used for the data analysis. Citation per paper (CPP), Compound Annual Growth Report (CAGR) was calculated.

ANALYSIS

Document Types

The search term "Vocational education* OR Vocational training*" in 'topic' field of Web of Science Core Collection database yield a total of 3703 records when performed a Boolean search using OR operator for the period of study. These 3703 records had received 26940 citations. The results show that the most of the knowledge is diffused in the form of articles (3361 papers). This contributes more than 90% of the total knowledge share followed by Review 4.40% (163 records) and proceeding paper 2.18% (81 records). The probable answer to the higher share of journal articles is because of the timely publication, peer reviewed, and online availability of content. Among the 3703, English language document is more than 86% (with 3190 records), followed by other European languages German 5.75% (with 213 records), Spanish 2.75% (with 102 records), French 1.37% (with 51 records), Portuguese 0.99% (with 37 records). However, the English is the second largest spoken language in the world by number of speakers speaks it, but it seems to be the largest language for communication. Even other European languages do not come under five largest spoken language but these are widely used for communicating the scholarly ideas (12).

Year-Wise Growth of Publications and citations

During the decade 2006-2015 total of 3703 records were published, which received 26940 citations. At an average 370.3 documents were published every year. There is a significant growth of publication as there were only 195 publications in 2006 in VET. The year 2015 was the highest productive year as the

largest amount of documents (671) was brought out in 2015. The highest Compound Annual Growth Rate (CAGR) of publications (56%) was observed in 2015. However, the lowest CAGR was in the year 2014 (5%). While, in the year 2013, negative (-7) CAGR of publications was observed. The impact of the publication during the period seems to be very high on the VET academic community as the average citation ratio is more than seven times (7.27 CPP). Table 1: Periodic growth of publications and Figure: 1, given below gives glimpses of the yearly growth of publications and citations.

Table 1: Periodic growth of publications

Year	Total publications	% of total publications	Compound Annual Growth Rate of documents	Citations	Citation per paper
2006	195	5.266%	--	2978	15.271
2007	223	6.022%	14%	3932	17.632
2008	261	7.048%	17%	3376	12.934
2009	302	8.155%	16%	3354	11.105
2010	376	10.153%	25%	3259	8.6675
2011	394	10.640%	5%	3215	8.1598
2012	440	11.882%	12%	2719	6.1795
2013	410	11.072%	-7%	1898	4.6292
2014	431	11.639%	5%	1363	3.1624
2015	671	18.120%	56%	846	1.2608
Total	3703	100		26940	7.275

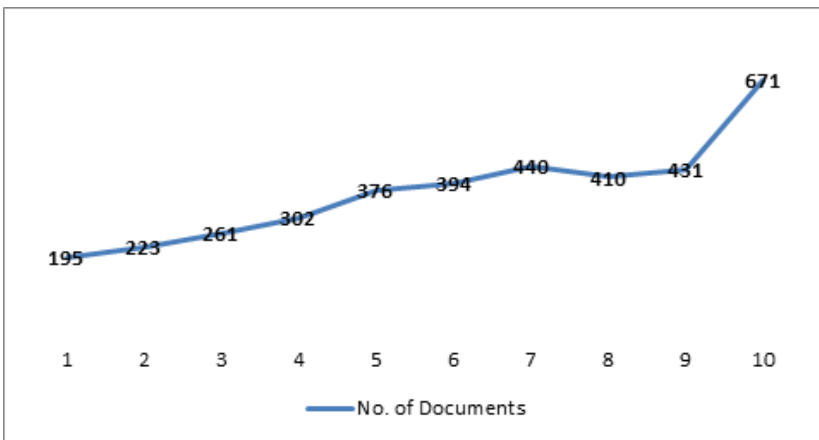


Figure 1: Periodic Growth of Documents

Geographic Distribution of Publications and citations of highly productive countries in VET.

Among all the countries the England has the highest share in the most productive country with 1196 (32.29%) publications followed by the USA with 1160 (31.32%) publications, Germany with 287 (7.75%) publications, Netherlands with 281 (7.58%) publications, and Australia with 113 (3.05%) publications. The publications share from the USA has attained highest number of citations share, which is more than the 45% of the total share (with 12148 citations), followed by the England with 36% and, Netherlands with 5.89% world share of citations.

Sweden has the highest rate of Citation per Paper (CPP) 10.69, followed by the USA 10.47 and England with CPP of 8.12. Russia (0.13 CPP), India (0.33 CPP), Spain (0.50 CPP), Bosnia & Herceg (0.58) and South Africa (0.8 CPP) has lowest CPP, less than 1 per item. The breakup wise share of the VET publications, citations and CPP of Top 25 countries is given in Table: 2 (Top 25 countries in the world).

Table 2: Most Productive 25 countries in the world

S. No.	Country	Documents	% of 3703	Citations	Citation Per Paper	% of citation
1	England	1196	32.29%	9714	8.122	36.057
2	USA	1160	31.32%	12148	10.472	45.092
3	Germany	287	7.75%	959	3.341	3.559
4	Netherlands	281	7.58%	1587	5.647	5.890
5	Australia	113	3.05%	583	5.159	2.164
6	Spain	73	1.97%	37	0.506	0.137
7	Turkey	69	1.86%	152	2.202	0.564
8	France	47	1.26%	80	1.702	0.296
9	Switzerland	41	1.10%	234	5.707	0.868
10	Brazil	35	0.94%	37	1.057	0.137
11	Poland	33	0.89%	77	2.333	0.285
12	Ireland	28	0.75%	280	10	1.039
13	Canada	23	0.62%	101	4.391	0.374
14	Croatia	21	0.56%	26	1.238	0.096
15	Scotland	21	0.56%	119	5.666	0.441
16	Italy	16	0.43%	64	4	0.237
17	Japan	16	0.43%	60	3.75	0.222
18	Romania	16	0.43%	24	1.5	0.089
19	Russia	15	0.40%	2	0.133	0.007

20	South Africa	15	0.40%	12	0.8	0.044
21	Norway	14	0.37%	196	14	0.727
22	New Zealand	13	0.35%	51	3.923	0.189
23	Sweden	13	0.35%	139	10.692	0.515
24	Bosnia & Herceg	12	0.32%	7	0.583	0.025
25	India	12	0.32%	4	0.333	0.014

Highly Productive Authors and Organisations in VET

The data reveals that Chan F and Salmela-Aro K are the highly productive authors yielding 14 documents with 0.380 % share. Followed by Bell MD, 11 (0.298 %), Brug J, 11 (0.298 %), Meijers F, 11(0.298 %), Trautwein U, 11 (0.298 %), Morgan S, 10 (0.271 %), Stevens Paj, 10 (0.271 %) and Van Houtte M, 10 (0.271 %) only have number of publication in double digit. Below Table 3: Top 25 Highly Productive Authors in VET is providing an account of highly productive authors in VET.

Table 3: Top 25 Highly Productive Authors in VET

S. No.	Name of Authors	Record Count	% of 3703	Affiliation
1	Chan F	14	0.37%	University of Wisconsin, USA
2	Salmela-Aro K	14	0.37%	University of Helsinki, Finland
3	Bell MD	11	0.29%	Yale University, USA
4	Brug J	11	0.29%	Vrije University, Netherlands
5	Meijers F	11	0.29%	The Hague University, Netherlands
6	Trautwein U	11	0.29%	Tubingen, The Hector Research Institute of Education Sciences and Psychology, Germany
7	Morgan S	10	0.27%	General Practice Training Valley Coast, Australia
8	Stevens Paj	10	0.27%	Ghent University, Belgium
9	Van Houtte M	10	0.27%	Ghent University, Belgium
10	Winch C	10	0.27%	Kings College London, England.
11	De Bruijn E	9	0.24%	Utrecht University, Netherlands
12	Nagy G	9	0.24%	Leibniz Institute for Science and Mathematics Education, Germany
13	Drake RE	8	0.21%	Geisel School of Medicine at Dartmouth, Department of Psychiatry, USA
14	Hamalainen R	8	0.21%	University of Jyvaskyla, Finland

15	Haug S	8	0.21%	University of Zurich, Swiss Research Institute for Public Health and Addiction, Switzerland
16	Mcgrath S	8	0.21%	University of Nottingham, England.
17	Taylor JL	8	0.21%	Vanderbilt University, USA
18	Tsai CW	8	0.21%	Ming Chuan University, Taiwan
19	Frings-Dresen MHW	7	0.18%	University of Amsterdam, Netherlands
20	Killackey E	7	0.18%	The University of Melbourne, Australia
21	Ludtke O	7	0.18%	Leibniz Institute for Science and Mathematics Education, Kiel, Germany
22	Meyer C	7	0.18%	University Med Greifswald, Institute of Social Medicine & Prevention, Germany
23	Nurmi JE	7	0.18%	Univ of Jyvaskyla, Finland
24	Tsang HWH	7	0.18%	The Hong Kong Polytechnic University, Peoples R China
25	Van Dijk FJH	7	0.18%	University of Amsterdam, Netherlands

Among the productive Organisations, the highly productive universities were: University of Amsterdam, Netherlands with 58 (1.56%) publications and University of Melbourne, Australia with 48 (1.302%) records, University of Utrecht Netherlands with 42 (1.139%) publications, University of Groningen, Netherlands with 35 (0.950%) publications, University of Queensland, Australia with 35 (0.950%). There is no surprise to know that the universities from the USA, Netherlands and Australia are forming the core of highly productive Organisations in VET. Below table shows the Top 25 highly Productive Organisations.

Table 4: Top 25 Highly Productive Organisations in VET

S.No.	Organisations	Country	Record Count	% of 3703
1	University of Amsterdam	Netherlands	58	1.56%
2	University of Melbourne	Australia	48	1.29%
3	University of Utrecht	Netherlands	42	1.13%
4	University of Groningen	Netherlands	35	0.94%
5	University of Queensland	Australia	35	0.94%
6	Maastricht University	Netherlands	32	0.86%
7	Monash University	Australia	32	0.86%
8	University of Jyvaskyla	Finland	32	0.86%
9	University of Sydney	Australia	32	0.86%

10	University of Ghent	Belgium	30	0.81 %
11	University of Helsinki	Finland	30	0.81 %
12	University of Wisconsin	USA	30	0.81 %
13	Griffith University	Australia	26	0.70%
14	University of Nottingham	UK	26	0.70%
15	University of Zurich	Switzerland	26	0.70%
16	Kings College London		25	0.67%
17	University of Illinois	UK	25	0.67%
18	University of North Carolina	USA	24	0.64%
19	Yale University	USA	23	0.62%
20	Penn State University	USA	22	0.59%
21	Harvard University	USA	21	0.56%
22	Michigan State University	USA	20	0.54%
23	Vrije University Amsterdam	Netherlands	20	0.54%
24	University of Toronto	Canada	19	0.51%
25	Vanderbilt University	USA	19	0.51%

Highly Productive Journals

Journal of Vocational Behavior is the leading journal with 52 records (1.40% %) followed by Vocations and Learning with 48 records counts (1.29%), Work A Journal of Prevention Assessment Rehabilitation with 42 records (1.13%), Rehabilitation Counseling Bulletin 35 publications (0.95%) and BMC Public Health with 34 records (0.91%), Zeitschrift Fur Erziehungswissenschaft, 32 publications (0.86%), International Journal of Educational Development, 31 publications (0.83%), Career Development Quarterly, 27 publications (0.72%), British Dental Journal, 26 publications (0.70%), Journal of Occupational Rehabilitation, 26 publications (0.70%). The average CPP is 6.94. The Articles published in the Journal of Vocational Behavior has the highest rate of CPP of 24.32 per article. The journal Revista De Educacion has the lowest CPP 0.95 per article. Below table 5 shows 25 most productive journals.

Table 5: Highly Productive Journals

S. No.	Source Titles	Record Count	% of 3703	Citations	Citation per paper
1	Journal of Vocational Behavior	52	1.40%	1265	24.32
2	Vocations and Learning	48	1.29%	287	5.97

3	Work A Journal of Prevention Assessment Rehabilitation	42	1.13%	127	3.02
4	Rehabilitation Counseling Bulletin	35	0.94%	162	4.62
5	BMC Public Health	34	0.91%	265	7.79
6	Zeitschrift Fur Erziehungswissenschaft	32	0.86%	89	2.78
7	International Journal of Educational Development	31	0.83%	180	5.80
8	Career Development Quarterly	27	0.72%	157	5.81
9	British Dental Journal	26	0.70%	109	4.19
10	Journal of Occupational Rehabilitation	26	0.70%	336	12.92
11	European Journal of Education	24	0.64%	65	2.70
12	Journal of Vocational Education And Training	24	0.64%	31	1.29
13	Journal of Career Assessment	22	0.59%	158	7.18
14	Journal of Rehabilitation	22	0.59%	81	3.68
15	Australian Journal of Adult Learning	21	0.56%	21	1
16	Australian Family Physician	20	0.54%	98	4.9
17	Revista De Educacion	20	0.54%	19	0.95
18	Journal of Career Development	19	0.51%	109	5.73
19	Studies In Continuing Education	19	0.51%	27	1.42
20	European Sociological Review	18	0.48%	218	12.11
21	Nurse Education Today	18	0.48%	83	4.61
22	Disability and Rehabilitation	17	0.45%	273	16.05
23	Economics of Education Review	17	0.45%	145	8.52
24	International Journal of Manpower	17	0.45%	37	2.17
25	Oxford Review of Education	17	0.45%	156	9.17
Total		648	17.49%	4498	6.94

Highly Cited Publications

The study reveals that there are 13 VET publications are highly cited (which have got 100 or more citations) during the period of study. The table below has a list of these highly cited documents. The paper "*A meta-analysis of cognitive remediation for schizophrenia: methodology and effect sizes*" by Wykes, T., Huddy, V., Cellard, C., McGurk, S. R., & Czobor, P. (2011), is the most frequently cited one with 459 citations followed by the paper the by Ferreira, I., et.al., (2007), entitled "*Environmental correlates of physical activity in youth-a review and update*" received 394 citations, paper authored by the Savickas, M. L. (2012), titled "*Life Design: A Paradigm for Career Intervention in the 21st Century*" attained 264 citations, 249 citations have been received by the study entitled "*8-year follow-up of patients*

treated for borderline personality disorder: mentalization-based treatment versus treatment as usual” by the Bateman, A., & Fonagy, P. published in the year 2008, the paper authored by Westerberg, H. and others published in the year 2007, titled as “Computerized working memory training after stroke--a pilot study” have 174 citations. These 13 collaborative publications mentioned in the Annexure-I, had received 2460 citations, this constitutes the core of the subject as these publications attain more than 22% of total citations received during the period. 88.70 average citations received by per publication when compared the publications. The table 6 given below shows the citation classics in VET.

Table 6: Citation classics in VET (≥100 citations)

S. No.	Bibliographic details	Times cited
1	Wykes, T., Huddy, V., Cellard, C., McGurk, S. R., & Czobor, P. (2011). A meta-analysis of cognitive remediation for schizophrenia: methodology and effect sizes. <i>The American Journal of Psychiatry</i> , 168(5), 472-485.	459
2	Ferreira, I., van der Horst, K., Wendel-Vos, W., Kremers, S., van Lenthe, F. J., & Brug, J. (2007). Environmental correlates of physical activity in youth-a review and update. <i>Obesity Reviews: An Official Journal of the International Association for the Study of Obesity</i> , 8(2), 129-154.	394
3	Savickas, M. L. (2012). Life Design: A Paradigm for Career Intervention in the 21st Century. <i>Journal of Counseling & Development</i> , 90(1), 13-19.	264
4	Bateman, A., & Fonagy, P. (2008). 8-year follow-up of patients treated for borderline personality disorder: mentalization-based treatment versus treatment as usual. <i>The American Journal of Psychiatry</i> , 165(5), 631-638.	249
5	Westerberg, H., Jacobaeus, H., Hirvikoski, T., Clevberger, P., Ostensson, M.-L., Bartfai, A., & Klingberg, T. (2007). Computerized working memory training after stroke--a pilot study. <i>Brain Injury</i> , 21(1), 21-29.	174
6	Lubinski, D., & Benbow, C. P. (2006). Study of Mathematically Precocious Youth After 35 Years: Uncovering Antecedents for the Development of Math-Science Expertise. <i>Perspectives on Psychological Science</i> , 1(4), 316-345.	139

7	Iversen, T., & Stephens, J. D. (2008). Partisan Politics, the Welfare State, and Three Worlds of Human Capital Formation. <i>Comparative Political Studies</i> , 41(4-5), 600-637.	136
8	Shattuck, P. T., Narendorf, S. C., Cooper, B., Sterzing, P. R., Wagner, M., & Taylor, J. L. (2012). Postsecondary Education and Employment Among Youth With an Autism Spectrum Disorder. <i>Pediatrics</i> , peds.2011-2864.	
9	Taxman, F. S., Perdoni, M. L., & Harrison, L. D. (2007). Drug treatment services for adult offenders: The state of the state. <i>Journal of Substance Abuse Treatment</i> , 32(3), 239-254.	108
10	Brunello, G., & Checchi, D. (2007). Does School Tracking Affect Equality of Opportunity? New International Evidence. <i>Economic Policy</i> , 22(52), 781-861.	107
11	Van Cauwenberghe, E., Maes, L., Spittaels, H., van Lenthe, F. J., Brug, J., Oppert, J.-M., & De Bourdeaudhuij, I. (2010). Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and "grey" literature. <i>The British Journal of Nutrition</i> , 103(6), 781-797.	107
12	Lindström, K., Winbladh, B., Haglund, B., & Hjern, A. (2007). Preterm Infants as Young Adults: A Swedish National Cohort Study. <i>Pediatrics</i> , 120(1), 70-77.	107
13	Viner, R. M., & Taylor, B. (2007). Adult outcomes of binge drinking in adolescence: findings from a UK national birth cohort. <i>Journal of Epidemiology and Community Health</i> , 61(10), 902-907.	103

CONCLUSION

The five objectives mentioned earlier were framed to assess the current trend of Knowledge Diffusion in VET. The aim of the study was to analyse the publication data to research, interpret and appraise the global emerging trends in VET. The purpose of the study is intended to provoke deliberate, aware stakeholder about the challenges that are likely to rise up in future. The identification of global practices is based on the data obtained from the Web of Science Core Collection Database. This study executed following five objectives: 1) domain-wise distribution of publication, 2) growth of publications and citations in VET, 3) geographic distribution of publications in VET and to examine their citation impact, 4) identification of most prolific authors and institutions, 5) highly preferred journals and 6) highly cited publication.

In VET Journals are preferred sources of knowledge diffusion then other sources as the more than 90% knowledge flows in the form of articles. English is the

highly preferred language for communication. The year 2015 is the highest productive year (671 publications). Average citation per paper published per year is 370.30, with 7.27 average citations per item. The h-index in VET is 55. The England with 1196 (32.29%) and the USA with 1160 (31.32%) publications are the most prolific country. The Chan, F, (University of Wisconsin, USA) and Salmela-Aro K (University of Helsinki, Finland), are the most prolific authors (with 14 publications each). University of Amsterdam, Netherlands is the most productive organisation with 58 records. Journal of Vocational Behavior has achieved highest CPP 24.32 per item and ranked on top with 52 record counts. 13 highly cited papers during the period having citation ≥ 100 are identified and these publications received 2468 citations. This constitutes 9.13% of total share of citations received during the period. The study also explored the major research thrust areas in VET, which are Business Economics, Economics, Education and Educational Research, General Internal Medicine, Psychiatry, Applied and Educational Psychology, Public Environmental Occupational Health, Rehabilitation, Social Sciences, and Sociology, are highly researched.

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