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Comparative Analysis of Faculty of Natural Sciences and Social Science in Context of Knowledge Creation Practices

Hira Habib [*] | Marium Din [†] | Nabeela Shakur Abbasi [‡]

Abstract: *Knowledge is an important entity for every organization as knowledge creation leads towards a competitive advantage. The study was carried out to compare the knowledge creation practices of faculty of natural sciences and faculty of social sciences. Spiral knowledge creation theory was the base of the study, and objectives were to; 1) explore the status of knowledge creation practice of university teachers 2) compare the knowledge creation practices of faculty of natural sciences and social sciences. The total population was 4195 of 11 universities, from which 587 respondents were selected through stratified sampling technique. Descriptive statistics and independent t-test have been used for the analysis of data that get through a standardized questionnaire. The study concluded that the faculty of natural sciences create knowledge far better than the faculty of social science, for this faculty of social sciences need to involve in research and innovation activities.*

Key Words: knowledge Creation, Learning, Organization

Introduction

Knowledge creation is now necessary for the competitive world because the trend is now changing from resource-based to knowledge-based assets in an organization. Knowledge-based assets are most human capital; for that, globally, countries take an interest in knowledge creation. A competitive advantage is key for continuous knowledge creation in an organization. In this competitive, dynamic, and complex environment, the learning organization needs to be more effective in the knowledge creation and transformation process, which is new, advance, and practical. According to (Ichijo & Nonka, 2006), in twenty-first-century organizational members can extend their intellectual capabilities through the creation of new knowledge. The sustainability and success of any organization depend upon intellectual capital that is the part of knowledge creation by transferring and interpreting it (Sher & Lee, 2004; Kakabadse, A., Kakabadse. N. K., & Kouzmin, 2003)

In the history of civilization, attention towards information and knowledge is increasing fast than in the previous history of human civilization; according to Herbert Simon (1999) that the description of knowing has been transferred from memorization of knowledge to use and apply of information inappropriate way to get something productive from it.

The description of knowledge correctly is a little complicated. Recognition of the concept of knowledge creation and transfer is fundamental before debating on it as employees most of the time be unsuccessful in acquiring fresh and new knowledge due to mistakes of the exact concept. The recognition of data, information, and knowledge must be necessary for better understanding. In general, a raw fact which is unanalyzed is called data, and data that is analyzed and organized in proper information, and information having proper purpose or

[*] PhD Scholar, Department of Education, National University of Modern Languages, Islamabad, Pakistan.
[†] Assistant Professor, Department of Education, National University of Modern Languages, Islamabad, Pakistan. Email: mdin@numl.edu.pk
[‡] Lecturer, Department of Education, National University of Modern Languages, Islamabad, Pakistan.

meaning is called knowledge (Bhatt, 2001; Yahya & Goh, 2002; Mason & Pauleen, 2003).

The knowledge creation defined by Nonaka & Takeuchi, 1995 that constant and progressive sharing, combination, and transformation of various types of knowledge for learning and practising is called knowledge creation.

Nationally and internationally, countries take part in knowledge creation practices to meet the dynamic world trends by focusing on research and development activities and also support innovative ideas. The organizations focused on knowledge creation practices of their human capital by introducing different courses and programs to enhance collaboration, sharing, transferring, researching, and other activities that support knowledge creation practices. As Saxton (2000) said that Investment in education and training, research and development, and the structure of an organization or institution helps develop new technologies Goldin & Katz, 2009a, 2009b) that raise the productivity of resources.

The teachers updated knowledge and skills are very much important in this innovative world because teachers are the not only asset of an educational intuition but also effective for students also. For this purpose, higher education frequently conducts professional and personal training programs. After all these efforts, the knowledge index shows that the rank of Pakistan in the global knowledge index is 115.

The study is based on the Spiral theory of knowledge creation presented by Nonaka & Takeuchi (1995). The knowledge creation practices help teachers to think innovative because knowledge creation is a process that involves four practices; through the sequence of these practices, the teachers better understand their ideas and use them appropriately. The four practices are Socialization, Externalization, Combination, and internalization. These practices involve the continuous conversion of tacit and explicit knowledge as tacit knowledge is human insight, observation, and experiences that are unexpressive before told, and explicit knowledge is expressive knowledge.

Table 1

Practices	Conversion	Definition
Socialization	Tacit → Tacit	Transfer of knowledge through social involvement in the form of face-to-face interaction (informal discussion) with people or through experience sharing.
Externalization	Tacit → Explicit	Tacit knowledge expresses explicit knowledge for creating and sharing paradigms and metaphors.
Combination	Explicit → Explicit	Synthesize explicit knowledge sources into Metadata.
Internalization	Explicit → Tacit	Learning from reflection or learning by doing is called internalization.

The SECI model is widely approved, particularly in management expertise, because of insightfulness and fine depiction of knowledge and its types (tacit and explicit), even though the philosophical touch in the SECI model creates difficulties in research (Rice & Rice, 2005; Hosseini, 2011; Lee & Kelkar, 2013; Mani, Mubarak & Choo, 2014). The cognitive processes in an organization are described in the SECI model. SECI model addresses the knowledge as an entity that changes in a chained form regularly and constantly and is affected by organizations and individuals.

Rationale

Today's economies stand on knowledge-based resources, and it's very necessary nowadays to research knowledge creation; how knowledge creates and what practices we need to create knowledge? The organization's knowledge creation assets are based on tacit and explicit form, and the conversion of tacit and explicit knowledge comes with practices which are socialization, externalization, combination, and internalization; these practices are based on the Nonaka Spiral theory of knowledge creation. The knowledge creation practices encourage individuals to share their ideas and knowledge

with others. It starts with individuals and leads towards collective knowledge creation in an organization.

The research on educational organizations based on the Spiral Theory of Knowledge Creation is rare internationally, and in Pakistan, the research on knowledge creation in an educational institution cannot be done yet. The study explores the teacher knowledge creation practices with the use of tacit and explicit knowledge. The sharing and transferring of knowledge capabilities of teachers enhance the knowledge creation of an organization with a sequential process of practice.

Objectives

The study objectives were to

1. Explore the status of knowledge creation practice of university teachers.
2. Compare the knowledge creation practices of faculty of natural sciences and social sciences.

Literature Review

Learning and knowledge are basic parts of our lives. Learning is a general term, and knowledge has specific qualities. We learn every moment, but knowledge is a process for the implementation of what we learn.

Everyone is gaining knowledge through learning throughout life. Learning has common and knowledge has specified qualities, as everything and every moment we use our sense consciously and unconsciously for learning and the practical process of learning is knowledge.

A practical approach to learning through interaction with the nonstop process of transferring, combining, and converting distinct knowledge is called knowledge creation (Nonaka & Takeuchi, 1995). Simply, knowledge creation is a process of creating knowledge through observing, taking ideas from the environment, people, experience, and insights, transferred to others to enhance the idea, and implementation that idea to check the pros and cons of the concept.

Knowledge creation is an organizational learning theory, firstly presented by Nonaka & Takeuchi, 1995 with the name of the Spiral theory of knowledge creation. It is an organizational learning theory because the knowledge creation theory focuses on not only individuals and groups but the whole organization. The spiral knowledge creation is based on four components with the conversion of tacit and explicit knowledge. The four components are socialization, combination, externalization, and internalization.

- Socialization (Tacit → Tacit): Transfer of knowledge through social involvement in the form of face-to-face interaction (informal discussion) with people or through experience sharing.
- Externalization (Tacit → Explicit): Tacit knowledge expresses explicit knowledge for creating and sharing paradigms and metaphors.
- Combination (Explicit → Explicit): Synthesize explicit knowledge sources into Metadata.
- Internalization (Explicit → Tacit): Learning from reflection or learning by doing is called internalization.

An organization's potential to be trained and learned has been associated with an essential way of competitive advantage De geus, 1998, that is the main cause Hussein & Ishak (2006) narrated that organizational learning used to get better advantages of opportunities along with the quality of being responsive to development in an organization. Impressively, "organizational administration, management, and intellectuals have moved towards the realization that knowledge assets and intellectual capital can be the perfect supply of competitive advantage is the difference with the total dependence of traditional factors of production" (Morgan & Turnell, 2001). This provides proof to the reasons raised by Handy (1990) more than a period of thirty years ago, that the intellectual capabilities and knowledge resources of an organization stay a long time than the material resources.

The activities of universities significant connection to knowledge creation, e.g., research, directional advice from supervisors, and instruction from teachers. Therefore it is not correct to limit the knowledge creation practices to the universities (Siadat, Hoveida, Abbaszadeh, Moghtadaie, 2012) as the knowledge creation practices are not only enhance knowledge but increase organizational strength but collective learning in an organization is rare as the organizational learning grows with continuous change in the organizational knowledge assets.

The experienced and skilled organization in creating, obtaining, and sharing knowledge with continuous changes in employee's behavior according to new and fresh knowledge about learning organizations (Garwin, 1993). In the field of management sciences, the learning organization is a pretty new idea, and the learning organization is a kind of perfect form with that the promotion and facilitation of learning happened in organization's members (Hussein, Mohamad, Noordin & Ishak, 2014).

With innovative technologies, organizations learn continuously and enhance their knowledge assets to deal with future challenges. The developed learning organizations need to manage their assets by managers of organizations, and the managers must make sure that the learning should be constant and continuous without interruption. The learning process must be increased continuously and uninterruptedly. Sometimes organizations discontinue the learning process whenever the organization leads to a successful position, and the discontinuity of the learning process is the main reason for the failure of most organizations.

Initially, the organization is flexible, changeable, and `ready to learn, but as they reach in beginning of success and expansion level, the flexibility decreases due to rigidity and the energy and readiness to learn damage. The initial achievement introduced disappointment conditions in the organization because of the feeling of accomplishment; they observe nothing new to learn. The people in an organization are restless condition and waiting for chances. They have miss several new opportunities due to an unsustainable environment. Before the realization of organization condition, the competitors catch their opportunities, and this all situation makes downfall in an organization.

Deep-rooted learning is base on philosophy, central values, and organizational culture. Deep-rooted learning makes an organization able to face the unusual tomorrow situations. Additionally, for effectual double-loop learning, the leaders of an organization need to realize the worth of learning. Learning in an organization is the universal remedy for organizational durability.

Finally, leaders of the organization must shift their role from traditional to more innovative and broader cross-functional to promote productive dialogue, ideas implementation, and experimentation that build up a competitive environment for knowledge creation activities.

Knowledge is a highly researched area for researchers because of changing trends of the world, from physical resources to knowledge resources. Internationally many researchers, research knowledge creation in all sectors. Hosseini, 2011 researched knowledge creation by using Spiral knowledge creation theory and used a qualitative research approach and semi-structured interviews for data collection from professional facilitators of the educational sector. Travaille & Henriks, 2010 also researched on education sector by using the Nonaka Spiral theory of Knowledge creation to check out the success factor of knowledge creation in university research and researchers used a qualitative approach along with stratified sampling technique and using interviews as the instrument from researchers, technician, and leaders of the research institute of the university.

Siadat, Haveida, Abbaszadeh & Moghtadaie, 2012 also researched knowledge creation using the Nonaka spiral theory of knowledge creation at the university level with the use of a quantitative approach and took data from faculty members by using a questionnaire. Faith & Steam, 2018 researched knowledge sharing in academia, and the respondents were students and faculty. They used a quantitative approach and Nonaka Spiral theory of knowledge creation along with the use of questionnaires as an instrument.

As said earlier that the knowledge creation is not limited to the education sector only; therefore, many other researchers research knowledge creation practices of other sectors also. Lis, 2014 researched knowledge creation and conversion by using the Spiral theory of Knowledge creation on military organizations. Rice & Rice, 2005 studies knowledge creation with the multi-organizational investigation through literature by using Nonaka's Knowledge creation theory. Bandera, Keshtkar, Bartolacci, Neerudu & Passerni, 2017 took small and medium entrepreneurial firms Easa, 2012 carried the banking sector, and in both researches, a mixed-method approach has been used.

In the Pakistani context, work on knowledge creation is limited in all aspects. The researcher carried out only a few sectors, and all researchers have been used a quantitative research approach

for the study. Bashir Memon, Syed & Arain, 2017 took the banking sector, and Abbas, Rasheed, Habiba & Shahzad, 2013 also carried banking sector Ayub, Hassan, Hassan & Laghari, (2016) researched on cooperate sector.

Concludingly, knowledge creation is the most significant research topic for today's researchers as knowledge is the most important entity for every individual to every organization for survival. Every possible method and approach and also all sectors were taken by the researcher for researching knowledge creation using the knowledge creation theory of Nonaka. In Pakistan, only a few sectors have been taken by researchers, and most of the researchers used a quantitative approach for the research study of knowledge creation.

Methodology

Following methodology and procedure followed for the study.

Research Design

The study was based on descriptive survey research, and a quantitative approach was used to conduct the study. The study was based on a single variable, "knowledge creation", which is further sub-divided into four practices, and these practices are in the form of a process that converses with tacit and explicit knowledge.

Population

The population of the study was the university teachers of Rawalpindi and Islamabad. There are 29 universities (public and private) are in Rawalpindi and Islamabad; as per the HEC website, from these 29 universities, 11 universities were selected for conducting research. To more simplify the research study, the faculty of natural sciences and social sciences have been chosen. The population of the study was 4195 in total.

Delimitation of the Study

The study was delimited to

1. Universities of Rawalpindi and Islamabad
2. Faculty of Natural sciences and Social science

Sample and Sampling Technique

From population 587 or 14%, respondents have been selected for responses. A stratified random sampling technique was used to collect the data.

Instrument of the Study

A standardized questionnaire has been used for the study with the permit of a developer. The questionnaire was developed by Huang &Wang, 2002 who is Professor and Vice Dean in NCCA College of commerce in Taiwan. A Likert scale with a 5-point rating has been used to categorize the responses.

Data Collection

Responses have been collected by distributing the questionnaire to the respondents who are university teachers of natural sciences and social science faculty. Received responses were 560 or 13% which is a relatively good response rate.

Data Analysis

Descriptive statistics (frequency, mean, mode, percentage) and independent t-test has been used to analyze the data.

Results and Interpretation

The analysis has been done with the use of the SPSS program. The data analysis with its interpretation is given below.

Table 2. Status of knowledge creation practices of university teachers through Descriptive Statistic

S. No			Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
01	Cumulative Values Internalization	%				82.1	17.9
	Cumulative Mean Internalization	4.18					
02	Cumulative Values Externalization	%				53.6	46.4
	Cumulative Mean Externalization	4.46					

S. No			Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
03	Cumulative Values Socialization	%				71.4	28.6
	Cumulative Mean Socialization	4.29					
04	Cumulative Values Combination	%				67.9	32.1
	Cumulative Mean Combination	4.32					
	KC CUMULATIVE VALUES	%				71.	28.6
	KC CUMULATIVE VALUES	4.29					

1. **"Internalization:** (explicit knowledge to tacit knowledge)" cumulative value of responses shown that most of the respondents, about 69.3%, agreed, 29.7% respondents strongly agreed, and 1.0% were neutral views on queries about internalization (explicit knowledge to tacit knowledge). The cumulative mean value of internalization was 4.287.
2. **"Externalization:** (tacit knowledge to explicit knowledge)" cumulative value of responses depicted that most of the respondents, about 59.2% agreed, 40.8% of respondents strongly agreed on asked questions about externalization (tacit knowledge to explicit knowledge). The cumulative mean value of externalization was 4.408.
3. **"Socialization:** (tacit knowledge to tacit knowledge)" cumulative value of responses depicted that most of the respondents, about 62.0% agreed, 38.0% of respondents strongly agreed on questions raised about socialization (tacit knowledge to tacit knowledge). The cumulative mean value of socialization was 4.380.
4. **"Combination:** (explicit knowledge to explicit knowledge)" cumulative value of responses shown that most of the respondents, about 63.4%, agreed, 36.0% respondents strongly agreed, and 0.6% were neutral standpoints on queries about combination (explicit knowledge to explicit knowledge). The cumulative mean value of the combination was 4.354.

Knowledge creation (KC) cumulative values that get with the collection of four sections (internalization, externalization, socialization, and combination) in table 01 shown that the majority of respondents, about 66.3%, agreed and 33.7%, strongly agreed with all statements. The knowledge creation (KC) cumulative mean value was 4.337.

Table 3. Group statistics and T-Test Comparison of Faculty of Natural Sciences and Faculty of Social Science Knowledge Creation Practices

	Group Statistics				Levine's Test for Equality of Variances		t-test		
	Faculties	N	Mean		F	Sig.	T	Df	Sig. (2-tailed)
Internalization	NS	280	4.343	Equal variances assumed	104.929	0.000	7.672	558	0.000
	SS	280	4.157	Equal variances not assumed			7.672	471.536	0.000
Externalization	NS	280	4.505	Equal variances assumed	0.622	0.431	5.607	558	0.000
	SS	280	4.444	Equal variances not assumed			5.607	554.329	0.000
Socialization	NS	280	4.510	Equal variances assumed	7.668	0.006	11.765	558	0.000
	SS	280	4.347	Equal variances not assumed			11.765	504.519	0.000

	Group Statistics				Levine's Test for Equality of Variances		t-test		
	Faculties	N	Mean		F	Sig.	T	Df	Sig. (2-tailed)
Combination	NS	280	4.548	Equal variances assumed	19.245	0.000	9.244	558	0.000
	SS	280	4.381	Equal variances not assumed			9.244	532.518	0.014
Knowledge Creation (Cumulative)	NS	280	4.484	Equal variances assumed	11.024	0.001	13.984	558	0.009
	SS	280	4.344	Equal variances not assumed			13.984	557.069	0.001

In the group statistics box, the knowledge creation practices comparison between faculty of natural sciences and faculty of social sciences, the numbers of natural sciences faculty was 280, and the number of social sciences faculty was 280.

The knowledge creation practice is categorized into four groups based on tacit and explicit knowledge.

1. Internalization (explicit to tacit)
2. Externalization (tacit to explicit)
3. Socialization (tacit to tacit)
4. Combination (explicit to explicit)

Internalization (Explicit to Tacit)

The cumulative comparison between faculty of social sciences and faculty of natural sciences of knowledge creation practices, table 02, and row 01 is about internalization (explicit to tacit).

The mean value of faculty of natural sciences was 4.343, and the mean value of social science was 4.157. The mean value of natural science was higher than the mean value of social sciences.

The outcomes in the independent samples test table contained two rows:

a. Equal variance assumed; and
b. Equal variance is not assumed

The F value of Levene's test was 0.865 with the Sig. (p) value of 0.000. As shown in the table that Sig. (p) value of Levene's test was lower than our alpha 0.05, so we took "Equal Variances not Assumed" for t-statistics. The t-statistics showed that $t_{(471.536)} = 7.672$, $p < 0.000$ because the Sig. (p) value is lower than our alpha 0.05 shows that there is a significant difference between the faculty of social sciences and faculty of natural sciences knowledge creation practices (internalization).

Externalization (Tacit to Explicit)

The cumulative comparison between faculty of social sciences and faculty of natural sciences of knowledge creation practices, table 02, row 02 is about externalization (tacit to explicit)

The mean value of faculty of natural sciences was 4.505, and the mean value of social science was 4.444. The mean value of natural science was higher than the mean value of social sciences.

The outcomes in the independent samples test table contained two rows:

a. Equal variance assumed; and
b. Equal variance is not assumed

The F value of Levene's test was 0.622 with the Sig. (p) value of 0.431. As shown in the table that Sig. (p) value of Levene's test was greater than our alpha 0.05, so we took "Equal Variances Assumed" for t-statistics. The t-statistics showed that $t_{(558)} = 5.607$, $p < 0.000$ because the Sig. (p) value was smaller than our alpha 0.05 shows that there was a significant difference between faculty of social sciences and faculty of natural science knowledge creation practices.

Socialization (Tacit to Tacit)

The cumulative comparison between faculty of social sciences and faculty of natural sciences, table 02, row 03, is about socialization (tacit to tacit).

The mean value of faculty of natural sciences was 4.510, and the mean value of social science was 4.347. The mean value of natural science was higher than the mean value of social sciences.

The outcomes in the independent samples test table contained two rows:

a. Equal variance assumed; and
b. Equal variance is not assumed

The F value of Levene's test was 7.668 with the Sig. (p) value of 0.006. As shown in the table that Sig. (p) value of Levene's test was smaller than our alpha 0.05, so we took "Equal Variances not Assumed" for t-statistics. The t-statistics showed that $t_{(504.519)} = 11.765$, $p < 0.000$ because the Sig. (p) value was smaller than our alpha 0.05 shows that there was a significant difference between the faculty of social sciences and faculty of natural sciences knowledge creation practices (socialization).

Combination (Explicit to Explicit)

The cumulative comparison between faculty of social sciences and faculty of natural sciences knowledge creation practices, table 02, and row 04 is about combination (explicit to explicit).

The mean value of faculty of natural sciences was 4.548, and the mean value of social science was 4.381. The mean value of natural science was higher than the mean value of social sciences.

The outcomes in the independent samples test table contained two rows:

a. Equal variance assumed; and
b. Equal variance is not assumed

The F value of Levene's test was 19.245 with the Sig. (p) value of 0.001. As shown in the table that Sig. (p) value of Levene's test was smaller than our alpha 0.05, so we took "Equal Variances not Assumed" for t-statistics. The t-statistics showed that $t_{(532.518)} = 9.244$, $p < 0.014$ because the Sig. (p) value was smaller than our alpha 0.05 shows that there was a significant difference between the faculty of social sciences and natural sciences knowledge creation practices (combination).

Cumulative Knowledge Creation

The cumulative comparison between faculty of social sciences and faculty of natural sciences of knowledge creation practices, table 02, and row 05 included all statements (internalization, externalization, socialization, and combination) about knowledge creation practices cumulatively used to compare sample means showed below:

The mean value of faculty of natural sciences was 4.484, and the mean value of social science was 4.344. The mean value of natural science was higher than the mean value of social sciences.

The outcomes in the independent samples test table contained two rows:

a. Equal variance assumed; and
b. Equal variance is not assumed

The F value of Levene's test was 11.024 with the Sig. (p) value was 0.001. As shown in the table that Sig. (p) value of Levene's test was smaller than our alpha 0.05, so we took "Equal Variances not Assumed" for t-statistics. The t-statistics showed that $t_{(557.069)} = 13.984$, $p < 0.001$ because the Sig. (p) value was smaller than our alpha 0.05 shows that there was a significant difference between the faculty of social sciences and faculty of natural sciences knowledge creation practices.

Conclusion

It is concluded that most of the teachers agree about their involvement in knowledge creation practices, and also the inference is drawn from the result that externalization was the most used practice among the other three practices. It is also concluded from the result of the comparison of faculty of social sciences and faculty of natural science that the significant difference is shown between natural science and social science in all knowledge creation practice. The mean values of the comparative analysis show that the natural sciences were more involved in knowledge creation practices than the social sciences.

Recommendations

Nowadays, it's very difficult to describe the knowledge assets of teachers because of the fastest-changing world trend. Every day the knowledge entity change, and some new researches and innovations are presented. Therefore teachers should activate themselves in knowledge creation practices to enhance personal and professional growth.

There is a need to focus on internalization practices as internalization is related to learning by doing. Therefore teachers should involve in learning with practical implications which enhance their knowledge long run.

The faculties of social science should involve themselves in knowledge creation activities by participating in research and innovation activities.

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