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<tr>
<td>Author(s)</td>
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Is learning-by-doing via E-learning helpful to gain generic process knowledge?

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Abstract—Learning generic process knowledge is important to transform organizations from a function- to process-orientation to gain efficiency benefits. Empirical results on the learning method are rare, only showing that learning-by-doing is superior. We set up an e-learning program containing tasks based on a learning-by-doing approach. The results reveal that learning-by-doing with the e-learning system leads to a significant learning effect of almost 20 per cent.

Keywords: process knowledge, e-learning, learning-by-doing

I. INTRODUCTION

Compared with function-based organizations, process-focused organizations are expected to focus more on customers and quality, to adapt smoother to changes in the market and to deliver goods and services faster [1]. Today, many organizations are still function-oriented but there is a trend towards process-orientation to gain the mentioned benefits. This trend requires a fundamental change of mind by employees as the required knowledge of process-oriented and function-oriented organizations differs substantially. Thus, understanding how generic process knowledge can be learned is of major importance for practice and research [2].

However, a shift of mind is hard to achieve for employees as processes remain abstract or intangible. Results from other domains cannot be easily transferred as the learning style is mainly context dependent [3]. Only one study from [4] shows that learning-by-doing is superior in comparison to document studying in a classroom setting.

In the meantime, information technology (IT) and its diffusion have led to a geographical spread of workplaces. Employees often work on delivering the same service at different locations. Thus, understanding e-learning is helpful to provide an organizational learning platform independent from the geographical workplace.

II. GENERIC PROCESS KNOWLEDGE

A. Dimensions

Generic process knowledge covers the general idea regarding a process-oriented structure of an organization and process-oriented execution of tasks [1]. The narrow understanding emphasizes the level of individual processes, i.e. the structure within processes. Here, the process model should be set, responsibilities should be assigned and aligned goals should be formulated [4]. While the narrow understanding covers processes in isolation, the broad understanding focusses on the organization as a whole, i.e. the network of processes, employees, machinery and IT systems [5]. According to this view, organizations should be mainly designed along the value creation processes. The following dimensions describe generic process knowledge resting upon the broad understanding [1, 6]:

- **Customer**: Starting point for a process should be the customer and the process should cover every activity which is necessary to fulfill the customer’s order.
- **Goals**: Individual goals of employees should be aligned with the process goals.
- **Teams**: Employees working in the same process should be clustered in teams.
- **Hierarchy**: Hierarchical levels in the organization should be kept to a minimum.
- **Management**: Managers in the hierarchy should mainly be coaches enabling their employees to perform the tasks independently.
- **Continuous improvement**: It should be cross-functional to avoid uncoordinated improvements.
- **Narrow understanding**

B. Learning

Learning tacit knowledge (such as generic process knowledge), personal exchange [7], learning-by-doing [8] and use of explicit knowledge [9] can be used. There is only one study so far [4] providing evidence that learning by doing is more effective than documentations having a narrow understanding in a paper based learning environment.

E-learning refers to the use of computer technologies to create learning environments that aim to enhance individual and organizational performance [10]. The main advantages include its flexibility in access, just-in-time delivery and cost effectiveness. However, most existing e-learning applications have been developed primarily for school learning programs, ignoring the special features of learning in work situations [11].

There are some attempts to use learning-by-doing within e-learning, namely situated e-learning [12]. Results show that it is promising to be applied, but due to the context dependency leaving the question open how learning-by-doing helps in the given context. Moreover, e-learning applications tend to focus on technical issues and fail to understand the learning behavior in an organizational context [13]. Concluding, the hypothesis is that learning-by-doing in an e-learning setting leads to a significant increase of generic process knowledge.
III. DESIGN OF THE E-LEARNING ENVIRONMENT AND IMPLEMENTATION

A. Setting of the e-learning environment

The e-learning environment was set up in combination of the platform Moodle and the online survey tool Unipark. Within Moodle, participants could use a discussion forum and had access to the tasks on which they could work on repeatedly. Unipark was used to implement the tasks which were interactive by drag-and-drop features.

B. Measures

The measures are deducted from the dimensions in section II A (Table 1). In case of sub measures being used, the measure is calculated as the average of the sub measures. The task regarding the first six measures is characterized by four functions with four processes spanning across each function. A different setting is used for measuring the narrow understanding having twelve activities, five roles and goals to be assigned. Each measure is on a scale from 0 to 1.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measure</th>
<th>Sub Measure (Sub Dimension)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>End-customer focus</td>
<td>Customer relevance, end-to-end view</td>
</tr>
<tr>
<td>Goals</td>
<td>Goals compensation</td>
<td></td>
</tr>
<tr>
<td>Teams</td>
<td>Team forming</td>
<td>Alignment of process and teams, complete process teams</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Hierarchy building</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>Management practices</td>
<td>Leading employees, operative work</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>Continuous improvement</td>
<td></td>
</tr>
<tr>
<td>Narro understanding</td>
<td>Narrow understanding</td>
<td>Activities, roles, goals</td>
</tr>
</tbody>
</table>

The dimensions are measured as follows:

- **Generic process knowledge**: It is calculated as the average of the seven listed measures.
- **End-customer focus**: It can be indicated before and after each process (positive impact) as well as for the functions (negative impact) where the end-customer is seen as relevant (twelve possibilities in total).
- **Goals compensation**: Goals to evaluate the performance can be assigned to each process (positive impact) and each function (negative impact), i.e. eight in total.
- **Team forming**: 16 employees can be assigned to teams from purely functional (score: 0) ranging to purely process-oriented (score: 1).
- **Hierarchy building**: Hierarchy levels range from one (score: 1) to either three in case of two to four teams or four in case of five to eight teams (score: 0).
- **Management practices**: Assigning working time of managers to “leading employees” is rated positive while “operative working time” is rated negative.
- **CIP**: Five options for CIP are offered ranging from purely function-oriented (score: 0) to purely process-oriented (score: 1).
- **Narrow understanding**: We follow the established measurements of [4]. Within each sub measure answers are compared to a best practice solution.

C. Participants and procedures

The e-learning phase was integrated in an academic course on Principles of Management taught in classroom. The incentive for participants was to gain 10% of the overall grade with the e-learning phase. Out of 85 students (graduate level), 80 students (94.1%) participated fully. The e-learning phase consisted of three phases:

- **Pre-test**: Participants had to conduct a pre-test without any prior knowledge on the subject (three days period). Example for narrow understanding: Dining process; example for broad understanding: repair shop.
- **Training phase**: Participants had easier tasks with the same logic (narrow: loan application process; broad: hospital). A best-practice solution and an explaining text were provided. Within the forum, participants received a random sample solution for discussion. Thus, a double-loop learning process was triggered [14]. Total time period was one week.
- **Post-test**: The post-test (three days period) had an examination process (narrow understanding) and a parcel delivery company (broad understanding) as examples. It took place one week after the training phase to avoid a repetition bias.

Participants were informed about the schedule in advance and reminded with emails on the respective due date.

D. Data analysis

We apply the modified Kolmogorov-Smirnov test of goodness of fit to test whether our data is normally distributed. To test the hypothesis, we apply a pairwise t-test for normally distributed data and the Wilcoxon signed-rank test for non-parametric data.

IV. RESULTS FROM THE E-LEARNING PHASE

A. Descriptives

Participants are almost equally male (51.2 %) and female (48.8 %). The majority of participants (73) has already gained professional experience (M = 23.06 months, SD = 21.43, Min = 1, Max = 100). Average training time of the participants is 23.1 minutes (SD: 14.5 minutes) splitting up to 11 minutes (narrow understanding) and 12.1 minutes (broad understanding). The average repetition of training units is 1.17 (SD = .32). Active exchange was conducted by 18 participants (22.5 %) with 37 comments. However, 51 participants (63.8 %) had a look into the forum.

B. Results

Mean values and standard deviations of the performance scores are reported in Table 2.
Second case "team forming", the level of previous significant learning effect is observed. Contrary, in the context of CIP with a higher level of previous knowledge but a comparably high in the pre- and post-test. Thus, it seems that the existing high knowledge cannot be improved further room for improvement. It could be that more explanation or exchange between the participants is necessary. Overall, the hypothesis can be confirmed (T(79) = -5.709, p < .001). Each dimension except “team forming” (W(769.5, 1121.5), ns) and “narrow understanding” (T(79) = 0.462, ns) shows statistically significant results (End-customer focus: T(79) = -1.861, p < .04; Goals compensation: W(285, 750), p < .01; Hierarchy building: W(319.5, 1391.5), p < .001; Management practices: T(79) = -6.150, p < .001; CIP: W(221, 682), p < .01. Moreover, there is no moderating effect in the sample of learning time (F(1) = 1.785, ns) and previous work experience (F(1) = 0.198, ns).

V. CONCLUSIONS, LIMITATIONS AND FURTHER RESEARCH

The results show that learning-by-doing via e-learning can increase learners’ generic process knowledge by almost 20%. Overall, the results can be considered as strong taking into account the relatively short time participants spent, the low number of training repetitions and a limited forum exchange. However, the level of 59.6% still leaves some room for improvement. It could be that more explanation or exchange between the participants is necessary.

Regarding the sub measures, there is no learning effect with respect to “narrow understanding” and “team forming”. In the first case, the level of previous knowledge is comparably high in the pre- and post-test. Thus, it seems that the existing high knowledge cannot be improved further based on the chosen setting. However, there is the exception of CIP with a higher level of previous knowledge but a significant learning effect is observed. Contrary, in the second case “team forming”, the level of previous knowledge is below the average in the pre- and post-test. Here, the e-learning setting has to be improved as the potential is huge but not realized.

Some limitations should be taken into account: Firstly, further data regarding learning experience, motivation and exchange outside the e-learning system could be added. Secondly, different contexts have been used in the pre- and post-test to avoid a memorizing bias. There could be an influence of different understandings within both settings. Thirdly, a long-term learning effect was not measured as the pre-test occurred one week after the training.

TABLE II. PERFORMANCE SCORES OF THE MEASURES ON GENERIC PROCESS KNOWLEDGE

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Difference [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Generic process knowledge</td>
<td>0.488</td>
<td>0.109</td>
<td>0.596</td>
</tr>
<tr>
<td>End-customer focus</td>
<td>0.299</td>
<td>0.316</td>
<td>0.379</td>
</tr>
<tr>
<td>Goals compensation</td>
<td>0.289</td>
<td>0.351</td>
<td>0.444</td>
</tr>
<tr>
<td>Team forming</td>
<td>0.387</td>
<td>0.372</td>
<td>0.480</td>
</tr>
<tr>
<td>Hierarchy building</td>
<td>0.486</td>
<td>0.324</td>
<td>0.714</td>
</tr>
<tr>
<td>Management practices</td>
<td>0.515</td>
<td>0.158</td>
<td>0.647</td>
</tr>
<tr>
<td>CIP</td>
<td>0.725</td>
<td>0.237</td>
<td>0.816</td>
</tr>
<tr>
<td>Narrow understanding</td>
<td>0.711</td>
<td>0.087</td>
<td>0.705</td>
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REFERENCES