BUSINESS INTELLIGENCE APPROACH – A PRACTICAL TOOL FOR COMPETENCE BASED CURRICULUM DEVELOPMENT

Jussi Myllärniemi, Nina Helander, Pasi Hellsten, Tommi Mahlamäki, Santeri Repo

Tampere University of Technology (FINLAND)

Abstract

Higher education teaches students’ skills according to requirements of modern environment and employers. The professional identities are dynamic mix of technological and business-oriented skills, thus the curriculum is no longer able to remain static for decades. Curriculum mapping (CM) is a way to develop contents to respond to the dynamic environment. An active review process is required - a process where teachers are committed to development and comprehensive information about the actual curriculum is used. CM gives transparency, increases recognition of students’ skills, connects academic skills and professional know-how, and advances teachers’ togetherness.

CM is data-driven as well as competence-driven action. Business intelligence (BI) approach is a tool for such occasions; to support the complex process of competence based curriculum development. BI gives methodicalness to information gathering and analysis as well as to the rest of the process. BI process is a continuous process that consists of five phases: defining information needs, information gathering, information processing, information sharing and utilizing information and feedback. After having done the groundwork, the decisions are better founded.

This paper proposes that BI process model can help to identify the key stakehoders and data sources necessary for holistic competence based curriculum development. The paper is based on a case from higher education. Furthermore, the BI offers a systematic approach for development process. The case is a technical university developing her curriculum. The focus is on the first phases of the activities, i.e. the planning and the implementation phase, leaving out the actual courses. Empirical data is collected through semi-structured interviews and focus group discussions involving different stakeholder groups, e.g. students, alumni, company representatives, teachers and administrative personnel.

Keywords: curriculum planning, business intelligence process, higher education, case study.

1 INTRODUCTION

In higher education, we should be able to teach skills that modern environment and employers require from our graduating students now and in future. In a technical university context, our curriculums should be planned to support learning towards a multi-minded expert that is a combination of technological and business-oriented skills. Curriculum mapping is a method to develop curriculums to better respond to the requirements of today’s business environment. It is an active review process where comprehensive information about the actual curriculum is used to present the actual learning experiment of students (cf. [1], [2]).

Curriculum mapping is data-driven as well as competence-driven [2] approach. In this paper, we argue that business intelligence (BI) approach could be used as a practical tool to support the complex process of competence based curriculum development in higher education context. BI can be seen as a process for systematically acquiring and analyzing data and information from various sources to gain understanding about the organization’s environment to support decisions that are met for achieving organization’s objectives (cf. [3]). In BI process the different stakeholder views are taken into account comprehensively right from the beginning of the process, as the information needs are set based on the following questions: who needs this information, in what kind of form and for what kinds of purposes.

Based on an empirical case study from higher education setting, this paper proposes that BI process model can assist to identify the key stakeholders and data sources necessary for holistic competence based curriculum development. Furthermore, the BI process model offers a systematic approach for planning and implementing the development process in addition to the more pedagogic frameworks and models. The empirical case of this paper is from a technical university that is in the middle of a
significant curriculum development process. The empirical data focuses on the first phases of the curriculum development process, i.e. the planning phase of the degree program level competence based development, leaving out the level of implementation of the development process and the actual course implementation and follow-up phases. The aim of this paper is to provide a comprehensive curriculum mapping development plan for a degree program level development by applying the principles of BI approach.

Next, the theoretical settings and related research are elaborated. After that the findings are presented and finally conclusions are drawn based on the findings. In addition, some possible avenues for future research are brought up.

2 THEORETICAL SETTING

In higher education settings, we should be able to provide curriculums that support learning towards today’s fast changing business environment. In this, so called, super-complex world curriculum planning of higher education faces challenges [4]. For example, due to information overload and rapidly changing technologies, the demand for future expertise of university graduates is hard to predict. At least in our field, knowledge management that necessitates experts that have combination of technological and business-oriented skills.

Curriculum mapping is a method or technique to develop curriculums to better respond to the requirements of today's environment and to lead students toward future studies [2]. Curriculum mapping is competence- and data-driven approach to curriculum planning. According to Jacobs [1] “curriculum mapping is a procedure for collecting data about the actual curriculum through communication”. It is used to present the actual learning experience of students (cf. [1], [2]). Mainly communication is done with students and teachers. In curriculum mapping, teachers are committed to develop the big picture of learning. According to Wang [2] curriculum mapping makes degree more transparent, increases recognition of students’ work skills and hence enhance their employment possibilities, connects academic skills and professional know-how as well as the so called meta-skills, and advances teachers’ communality. Curriculum mapping is useful, for example, to students to make better decisions related to their learning journey.

However, curriculum mapping points out some thoughts or even challenges that need to be considered when aiming to modern higher-education curriculum. Due to turbulence of business environment, curriculum mapping necessitates dynamic knowledge instead of static. So, what is dynamic knowledge and where it could be gathered? Who are the participants that must be involved in planning? Besides teachers and students, business environment’s participants, like alumni, should be noted. In addition, dynamic knowledge should be proactive so we, curriculum planners, can be sure that knowledge we use is correct and accurate also 10 years from now.

Real-time requirements, continuous cooperation between different participants and curriculum planners, and demand for pro-activeness considering information and decisions are features curriculum mapping must tackle. The novel thinking is needed in modern business environment in where organizations are focusing more on monitoring competitors and industry, reporting activities and customer management. Diversity of information is emphasized and using only organizations’ internal information is deficient.

BI process model considers above-mentioned features rather comprehensively. By understanding the BI process model and its characteristics, curriculum mapping could be organized more efficiently and organizations could gain advantage as for use of knowledge.

According to the literature, BI may be seen as a process, which is systematically and knowingly collecting and analyzing data and information from various sources within an organization and also case-specifically outside the organizational boundaries. The objective of this process is to produce insights of the business trends, competitive environment, and daily operations. A more refined objective behind the process is to ensure the support for decisions that the organization’s management makes in order to reach the set business goals (cf. [3]). Both the significance of the insights and the quality of the information sources need to be assessed in correctly executed BI-function [5, 6, 7]. This may be interpreted to mean that the organization strives to gain control over the information universe, both internal and external. Organization’s objective is to manage it as best as they can to achieve the set business goals and exceed them if possible. In any case one of the focal issues is to avoid any surprises and thus to be prepared for various eventualities.
In general, BI’s continuous process is consisted of five main phases: defining information needs, information gathering, information processing, information sharing and utilizing information and feedback, as illustrated in Fig. 1.

The process commences with information needs specification. This phase requires a clear statement of the key intelligence topics and more specific questions concerning the current issues, problems, or trends [9], but most importantly, it also defines to which purposes the information will be gathered and who are the key stakeholders who should be involved in the process. Sometimes the questions need to be elaborated as their true nature may reveal itself only after some iteration. The specified information needs define the external and/or internal information sources that act as a foundation for collecting information or data. This means monitoring and evaluating various sources and actual information collecting. The organization needs to store the results to organization’s repositories.

In processing phase the information is analyzed and evaluated. An additional activity is to visualize it in a compact form, i.e. information products. Collected information is assessed and connected to existing knowledge-base; e.g. structured information of external environment is connected to the know-how of employees. This is where most BI tools prove themselves. Yet, the mere existence of information and information products is not enough. Knowledge and insights need to be shared with the organization in the dissemination phase. The required knowledge and insights must be formally or informally communicated to the decision-makers, at the right time in the right format, and via most suitable media. In the final phase of BI process, the utilization phase, information products are used for problem solving and decision making. By utilizing information and knowledge new information and understanding is formed and by adjusting the organizational operation the BI cycle starts over. Next, this kind of BI process model is applied step-by-step in a case course as a learning method.

3 EMPIRICAL CASE STUDY

The empirical case of this paper is from a technical university that is in the middle of a significant curriculum development process. The management of the case university has decided that all the degree programs provided by the university need to develop their curriculums based on holistic competence mapping. The schedule for the development work is as following: during the spring 2017 all the degree level competences need to be defined, and after this the development work will continue in defining the course level competences in line with the degree level set competences. This kind of competence based curriculum development is carried out in order to have overall picture of the varying and multiple degree programs provided by the university, but also to identify what is the competence profile of a graduating student from each of the degree programs.

The competence profiles are formed based on [10] building blocks: knowing, acting and being. Based on the profiles curriculums are formulated in spring 2018. This means constructing study modules, defining learning goals of courses and planning pedagogical solutions for conducting courses, using teaching technologies etc. The whole curriculum planning is done by involving different interest groups.
constantly to work. Encouraging, e.g. academic staff and students, to active dialogue and co-creation is recommended and could be beneficial in curriculum design [11].

However, the curriculum planning process is a complex task because of turbulence business environment, mass of information and changing information needs of interest groups. To complete the task, the business intelligence process model was selected to assist in forming competence based curriculum development plan. The plan is introduced in the next chapter.

4 RESULTS

Table 1 below musters the phases of the BI process model and the issues in the context. The plausible starting point for activities of this magnitude is to analyse the present state [12]. Equally important is to reach a consensus what is the objective in the endeavor, what is strived at [13, 14]. A focal feature to acknowledge is to ensure that the right questions are asked and right issues are contemplated as sometimes the actual need may be mixed with merely wanting something. This means that the correct stakeholders need to be recognized before their information needs may be discussed [6]. This is illuminated in Table 1. Management set the framework for the operation and rough guidelines for the initiative. After having recognized and clarified the various stakeholders and their preferences for information needs, the actual data and information gathering commences. Intuitively may be stated that this type of an approach requires resources, thus to ensure this early on, is vital. Following phases are information processing, sharing, and finally using it. The requirement to use the information is the ultimately goal of the process. In order to make all this happen a systematic plan is to be drawn and implemented. After having accomplished the sub-parts and especially in the end, a feedback/debriefing session is to be arranged in order to go over the proceedings and to learn from them.

**Table 1. Competence based curriculum development plan**

<table>
<thead>
<tr>
<th>BI process phase</th>
<th>Issues to take care of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining information needs</td>
<td>Recognizing the key interest groups and defining their viewpoint for curriculum planning:</td>
</tr>
<tr>
<td></td>
<td>• students</td>
</tr>
<tr>
<td></td>
<td>• alumni</td>
</tr>
<tr>
<td></td>
<td>• university staff (management, professors, researchers, teachers etc.)</td>
</tr>
<tr>
<td></td>
<td>• business partners</td>
</tr>
<tr>
<td></td>
<td>Information needs are twofold:</td>
</tr>
<tr>
<td></td>
<td>• needs for completing curriculum planning process</td>
</tr>
<tr>
<td></td>
<td>• needs of interest groups</td>
</tr>
<tr>
<td></td>
<td>Boundary conditions are crucial to be defined beforehand:</td>
</tr>
<tr>
<td></td>
<td>• what are the obligatory competences that a graduating student from a technical degree program need to have (primary, secondary, and meta)</td>
</tr>
<tr>
<td></td>
<td>• what is the aimed graduating schedule for a student set by the ministry of education</td>
</tr>
</tbody>
</table>
### Information gathering

Data and information are separated into different sources.

**Defining the key information sources:**
- Internal sources: professors, staff and current students
- Look outside the box. Listen and interview external sources: alumni and business partners
- Use also the ready-made secondary material and documentary sources
- Ministry of Education

Set a schedule and order for gathering the information.

Choose the most appropriate methods for gathering the information:
- Focus groups
- Semi-structured interviews
- Quantitative surveys
- Delphi

Dynamic information is crucial. Note, the power of benchmarking.

### Information processing

Involve different interest groups to analyze gathered information through a second round participatory discussion. Also for validating the gathered information.

Remember the limitations of the gathered information, as forecasting is never an easy task. Criticism is needed.

### Information sharing

Communication has to be constant and have to involve all interest groups, thus keep all the key stakeholders informed:
- Management
- Personnel (remember all personnel groups and don’t forget the hierarchy challenges)
- Students
- Business partners

Open communication assists to avoid the friction between participants, thus start the information sharing already in the beginning of the development process. This needs comprehensive documentation throughout the process.

Define the information sharing methods and channels, multichannel approach required:
- Discussion sessions
- Discussion forums and e-mails
- ICT platform for information warehousing

Define whether the emphasis is on personalization strategy (discussions, tacit knowledge) or externalization strategy (information systems, documentation, explicit knowledge). Preferably both.

### Utilizing information and feedback

Necessitates open knowledge sharing culture

Plan lessons learned sessions and develop feedback gathering methods and the reflection of the lessons learned. Collect feedback from every key stakeholders.

Make sure to assure quality of process outcomes, e.g. using PDCA-methods.

---

Some pre-requisites for the successful execution of the process include the support from the management, to provide the mandate to do all this, and a team capable, motivated, and resourced to do all the necessary tasks. The plan is equally vital to be there as is the team to execute it. For the organization it is of importance to take care of the post-project feedback sessions and reflection. This ensures that the lessons learned are indeed that and the next initiative of similar nature and scale comes up, the organization is at least a bit more ready for it.

### 5 CONCLUSIONS

In this paper we combine the business intelligence process model with five distinct phases to university’s curriculum mapping initiative as a rough sketch. The university’s operation has had these
features before; the curriculum has been developed before and various stakeholders have had a say in the development activities, to a degree that is. These actions have been more scattered by nature and even less managed. At the same time business environment’s demands for graduates has modernized at excitable speed. The division into phases and systematic nature required by the BI process model is a novelty. This enables the process to be lead methodically and is a part of ensuring the most beneficial execution of the required actions. Starting from the stakeholder recognition and data gathering in order to satisfy the information needs of various decision makers on multiple levels through the information processing all the way to the sharing of the information products (e. g. reports, statistics etc.) as well using the information products the process enables the decision making to use the scarce resources better and in more organized manner..

Curriculum mapping promotes a communicative culture [2]. According to Uchiyama and Radin’s study [15] curriculum mapping helped to create a supportive and collaborative environment. Based on our study, the findings support above mentioned considerations. With active dialogue between participants we have collected interest groups’ information needs, formed a clear goal for curriculum plan and collected rich information repository for following phases. This process is still ongoing at our university. The competence based curriculum development plan offers a tool for curriculum developers to tackle challenges planning processes usually face, like changing information needs, missing information or friction between influencers.

It could be said that curriculum mapping promotes better curriculum decisions. The competence based curriculum development plan enables using of diverse information sources more systematically and assures that the processed knowledge serves different interest groups’ needs better. However, we are still in the first phases of the degree program level competence based development, so the more comprehensive outcome will be reported at a later date. There are issues to take care of, like monitoring and assuring the quality of execution. In the future, for example, PDCA-cycle could be useful addition to our plan when considering control and continual improvement of process.

REFERENCES
