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How can Learning Analytics fit into a General Evaluation Framework and already be addressed during Learning Design?

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Abstract: In this paper, the author describes how learning analytics can be included within a general evaluation framework and be defined from the beginning of learning design for a learning opportunity. It is analyzed what part of a general evaluation framework will be covered by learning analytics and how learning analytics can contribute to the impact assessment using the generic Evaluation Framework for Impact Assessment (EFI) as an example. It will thereby be discussed how learning analytics can be addressed at the start of the design phase of the learning opportunity based on the reference process model from the international quality standard ISO/IEC 19796-1. Finally it is indicated how an extension of the learning design specification like PAS 1032-2 can be helpful for the introduction and support of learning analytics and summarized which further research is required.

Keywords: Learning Analytics, Evaluation Framework, Learning Design, Impact Assessment, Impact Measurement

1. Introduction

Learning analytics is becoming more and more a hot topic and important question for organizations and policy makers: How to monitor learning processes and to measure the learning outcomes and results and their impact. Learning analytics are starting to be broadly applied today and raise many open questions and issues concerning privacy and data protection. The different legal situations in all countries and the lack of global agreements are current barriers and the public discussions are only beginning now. All these important issues cannot be discussed here as this paper focuses on the potential integration of learning analytics into a general evaluation framework to address learning analytics already in the learning design.

Thus, in the second section of this paper it is described first how learning analytics can be included within a general evaluation framework: It is analyzed what part of a general evaluation framework will be covered by learning analytics and how learning analytics can contribute to the impact assessment using the generic Evaluation Framework for Impact Assessment (EFI) as an example. In the third section, it is thereby discussed how learning analytics can be included in and addressed at the start of the design phase of the learning opportunity based on the reference process model from the international quality standard ISO/IEC 19796-1. An extension of the learning design specification can be helpful for the introduction and support of learning analytics. Finally a summary is given in the conclusions with a foresight for future research.

2. Learning Analytics in a General Evaluation Framework

In this section of this paper it is discussed how learning analytics can be included within a general evaluation framework: It is analyzed what part of a general evaluation framework will be covered by learning analytics and how learning analytics can contribute to the impact assessment. The guiding question is what relation exists between learning analytics and a general evaluation approach following

the philosophy of Total Quality Management (TQM). For that, the generic Evaluation Framework for Impact Assessment (EFI) will be used as an example that will be introduced in brief first.

2.1 The generic Evaluation Framework for Impact Assessment (EFI)

The Evaluation Framework for Impact Measurement EFI was developed to close a gap for assessing and optimizing the holistic total quality development within learning, education and training. It combines the traditional (internal) evaluation of the processes and developed products with the (external) evaluation concerning the strategic objectives and impact that is becoming more and more crucial due to economic cost pressures and international competition. Through this connection, the Evaluation Framework for Impact Measurement EFI offers an adaptable model for the definition and specification of indicators for both, the internal lifecycle and the external relations.

The Evaluation Framework for Impact Measurement EFI is combining the measurement of two dimensions:

1. (Internal) Impact of (direct) Results as outputs and
2. (External) Impact of Outcomes as indirect results.

Using the Evaluation Framework for Impact Measurement EFI, the following theoretical procedure has to be applied in general:

First, the impact of the internal development and output as direct results will be measured by operative indicators. Within one given project or process the operative indicators will be related to the planned products of the project or process. The measurement of the operative indicators has to focus the two dimensions of the pilot implementations: (1) the internal processes and activities and (2) the internal results (to be tested).

Second, the impact of the external relations and outcomes as indirect results will be measured by strategic indicators. They will be related to the strategic objectives of a given project or process: The measurement of the strategic indicators has to focus the two dimensions of the given project or process: (1) the external processes and activities (within the whole organization and external relations) and (2) the outcomes and their impact and external relations.

The following figure presents the overview of the Evaluation Framework for Impact Measurement EFI and demonstrates its relations between the two dimensions of impact measurement (internal impact of pilots assessed by the operative indicators and external impact of outcomes assesses by the strategic objectives):

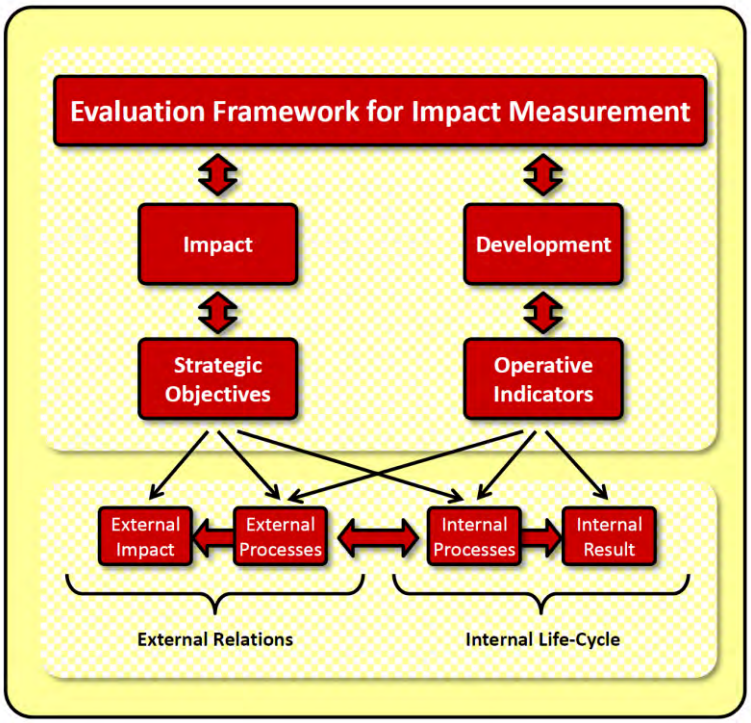

Figure 1. The Evaluation Framework for Impact Measurement EFI

2.2 Learning Analytics within the Evaluation Framework for Impact Assessment (EFI)

Learning Analytics is covering a broad range of different processes and results: It can start with monitoring the learning processes and providing feedback to the users as automatic recommendations for further progress as well as to the teachers, tutors or trainers as automatic indication which learners are progressing slowly or even failing and may require specific support and attention. Main objective of learning analytics is the measurement of the learning outcomes and results: Through their analysis it is expected that learning analytics are also contributing to the assessment of the impact. On the other hand, general evaluation frameworks have been developed during the last decades following the philosophy of Total Quality Management (TQM) and dealing with impact assessment, too. Thus, it is important to clarify their relationship and to combine and integrate them.

Therefore the guiding question is what relation exists between learning analytics and a general evaluation approach. General evaluation frameworks for a total quality management are addressing and covering all processes starting with the needs analysis whereas learning analytics is only starting with the learning process itself. Even though the concept and design of learning analytics should be discussed and defined from the beginning, the focus and scope of learning analytics is limited compared with holistic total quality management. Thus, learning analytics has to be part of a broader general evaluation framework like the Evaluation Framework for Impact Assessment (EFI).

Within EFI, learning analytics can directly support the impact assessment of the internal results, i. e. the learning outcomes of the learners achieved within the learning processes of the provided learning opportunity (e. g. by measuring the increase of knowledge, skills and competences in relation to the defined learning objectives). In addition learning analytics can also focus the assessment of the internal processes, i. e. the learning processes (e. g. by assessing the given answers and providing recommendations for further reading and in-depth learning).

For this purpose it is important that the operative indicators defined within EFI for the internal results and processes are also reflecting and aligned with the objectives of the learning analytics. On the other hand the operative indicators for the learning analytics has to be defined carefully that they can also contribute as input for the external impact assessment realized within EFI through the strategic objectives and related indicators. Then the indicators for the learning analytics can not only serve to

monitor the learning processes (as internal products) and to measure the learning outcomes (as internal products) but also to support the assessment by EFI of the external impact on the organization, external stakeholders and the society.

3. Learning Analytics within Learning Design from the beginning

In this section, it is discussed how learning analytics can be addressed at the start of the design phase of the learning opportunity. The reference process model from the international quality standard ISO/IEC 19796-1 is an approach developed and approved in consensus as well as implemented worldwide. As it is covering the full life cycle of any learning opportunity, learning analytics is included even though it is not explicitly mentioned. In the following the role of learning analytics within this general reference process model should be identified: Therefore the international quality standard ISO/IEC 19796-1 will be introduced in brief first.

3.1 The international quality standard ISO/IEC 19796-1

The standard ISO/IEC 19796-1 is the first international quality standard for learning, education and training and provides a common reference framework for learning processes. It was developed in consensus by the Working Group 5 "Quality Assurance and Descriptive Frameworks" of the standardisation committee ISO/IEC JTC1 SC36 and issued by the International Organization for Standardization (ISO) in 2005. It contains the reference process model "Reference Framework for the Description of Quality Approaches" (RFDQ) to support stakeholders in learning, education, and training to document and (re-)define their daily business and processes. The reference process model of ISO/IEC 19796-1 is the integration of the following two main reference models (cf. ISO/IEC 2005):

- the generic process model and
- the generic descriptive model.

The reference process model covers the whole lifecycle of learning, education, and training in general including e-Learning and blended learning. Therefore it can be used to describe any learning scenarios as well as any educational and vocational training product and learning solution. It is important to note that the reference process model does not include any regulations about the sequence of the processes or interdependencies between them as well as it does not give any instructions on its specific implementation in detail as a prescription or regulation. The reference process model serves as an open descriptive framework that always needs the adaptation to the organisation, the learning context, and the given situation. The reference process model is based on the generic process model that is divided into seven process categories containing in total 38 processes. It is described by the following table:

Table 1: The process model of ISO/IEC 19796-1

ID	Category	Description	Processes
NA	Needs Analysis	Identification and description of requirements, demands, and constraints of an educational project	NA.1 Initiation NA.2 Stakeholder Identification NA.3 Definition of objectives NA.4 Demand analysis
FA	Framework Analysis	Identification of the framework and the context of an educational process	FA.1 Analysis of the external context FA.2 Analysis of staff resources FA.3 Analysis of target groups FA.4 Analysis of the institutional and organisational context FA.5 Time and budget planning FA.6 Environment analysis
CD	Conception / Design	Conception and Design of an educational process	CD.1 Learning objectives CD.2 Concept for contents CD.3 Didactical concept / methods CD.4 Roles and activities CD.5 Organisational concept CD.6 Technical concept CD.7 Concept for media and interaction design CD.8 Media concept CD.9 Communication concept CD.10 Concept for tests and evaluation CD.11 Concept for maintenance
DP	Development / Production	Realization of concepts	DP.1 Content realization DP.2 Design realization DP.3 Media realization DP.4 Technical realization DP.5 Maintenance
IM	Implementation	Description of the implementation of technological components	IM.1 Testing of learning resources IM.2 Adaptation of learning resources IM.3 Activation of learning resources IM.4 Organisation of use IM.5 Technical infrastructure
LP	Learning Process	Realization and use of the learning process	LP.1 Administration LP.2 Activities LP.3 Review of competency levels
EO	Evaluation/ Optimization	Description of the evaluation methods, principles, and procedures	EO.1 Planning EO.2 Realization EO.3 Analysis EO.4 Optimization/ Improvement

3.2 Learning Analytics within the Reference Process Model

The reference process model of ISO/IEC 19796-1 is a valuable and general instrument for the implementation and establishment of quality development in Learning, Education and Training (LET) and beneficial for the introduction of total quality management (cf. Stracke 2010). It has to be identified the role that learning analytics can play within it.

Several processes of the reference process model of ISO/IEC 19796-1 can be identified that are directly relevant for learning analytics and addressed by it: Learning analytics is measured during the process Activities (LP.2) of the process category Learning Process (LP) as part of the process Realization (EO.2) of the process category Evaluation/Optimization (EO). It has to be defined during the process planning (EO.1) of the same process category Evaluation/Optimization (EO) and is finally contributing to the process Analysis (EO.3). As already mentioned above, learning analytics should also be addressed from the beginning of the needs analysis and learning design: Thus, it would be necessary to include learning analytics into the definition of learning opportunities and their needs and design.

The identified processes from the reference process model of ISO/IEC 19796-1 can be used for the further refinement of indicators for learning analytics: As mentioned before, it is crucial that learning analytics are contributing to the general evaluation framework and that the indicators for assessing the impact of the learning opportunities have to be defined already during the learning design process in line with the overall evaluation as well as with the learning analytics.

An extension of the Learning Design (LD) specification developed by Rob Koper and his team at the Open University of the Netherlands in the year 2001 could be helpful for the introduction and support of learning analytics: The open Publicly Available Specification (PAS) DIN 1032-2 was developed by a working group of the German Standardization Body DIN based on the Learning Design: The main amendment is the introduction of the category context to define the environment and its conditions. This additional category is important for the learning analytics as it is providing the basic information for the definition of indicators measuring the learning outcomes.

Further research can reveal and transfer these conditions for the improvement of learning analytics within the evaluation planning and learning processes. And in particular learning analytics can support the enabling of new ways for the impact assessment of learning opportunities within a general evaluation framework that has to be discovered and discussed.

4. Conclusions

This paper presented how learning analytics can be included within a general evaluation framework and already be defined at the beginning of the learning design. For this specific purpose all open questions and issues concerning privacy and data protection that arise from a broad application of learning analytics were excluded: Such questions were outside of the scope of this paper, but must be addressed and are very important for a successful introduction of learning analytics. The generic Evaluation Framework for Impact Assessment (EFI) was introduced as an example of a general evaluation framework and could identify which part of it is covered by learning analytics as well as how learning analytics can contribute to the impact assessment. Based on the reference process model from the international quality standard ISO/IEC 19796-1, it was demonstrated that learning analytics can already be addressed during the start of the design phase for a learning opportunity. An extension of the Learning Design specification can contribute to the introduction and support of learning analytics. Future research should focus on the open question as to how the introduction of learning analytics can be harmonized in different systems and for different target groups and organizations by using standardized phases and processes such as the IDEAL reference framework. This would lead to comparable and hopefully interoperable learning analytics systems and data for the analysis and benchmarking across different systems, target groups and organizations.

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