

Towards a Model for Learning Outcomes - Experiences from a Project-Oriented Course

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Abstract

This paper describes an overall model that can be used by a teacher when working with learning outcomes. The model is presented in the context of a project-oriented course and contains three stages. It describes how a teacher can: (1) create a learning breakdown structure with learning modules; (2) define learning activities including feedback, assessment, and examination activities for the learning module; and (3) develop a learning chart that visualises how the learning should be accomplished. The description of the three stages can also be applied to general steps when developing a Gantt chart with project management tools. The work starts in a course with analysing the learning outcomes in the syllabus and breaking it down into learning modules. A learning activity list is subsequently created, which identifies attributes that are associated with each learning activity. This list also includes activities for feedback, assessment and examination of each learning module. Finally, work begins to create relationships between the learning outcomes and learning activities on a calendar-based time axis, which leads to the development of a learning chart. The experiences discussed and analysed here are based on project-oriented education in the context of an undergraduate course at a Swedish university.

Keywords: Learning outcomes, learning chart, active learning, project management tool, student-centred education, course design

1. INTRODUCTION

A cornerstone of the Bologna Process in Europe (European Association for Quality Assurance in Higher Education, 2005) is the development and publication of explicit, intentional learning outcomes. Defining and using learning outcomes (e.g., in a syllabus) can then be the starting point for designing, starting, execut-

ing, ending and evaluating a course. Learning outcomes are statements that express what a learner is expected to know, understand, and/or be able to demonstrate after completing a learning process (European Commission, 2004).

This paper focuses on the challenges of teaching according to how students learn and how to

facilitate explicit learning outcomes in the syllabi of students and teachers. It describes and analyses how to apply, in practice, learning outcomes in an overall model, a learning chart, since good teaching involves learning activities that lead to the attainment of the explicit, intentional learning outcomes. "Learning activity" refers to an activity that supports student learning. In this paper, "teacher" refers to a person or persons with overall responsibility for a course; depending on the type of university course, a teacher may be an individual course leader, an instructor team, or an examiner. This paper touches on topics relevant to university teachers interested in how to work with learning outcomes, such as general courses touching indirectly on information systems (as is often the case in information systems courses (Schwalbe, 2005; Marchewka, 2006)), and specific information systems courses.

The paper is arranged in the following sections: Section 2 presents the research approach, Section 3 describes the theoretical frame for the model, Section 4 describes how to manage the learning outcomes, and Section 5 and 6 presents concluding remarks and identifies areas for future research.

2. RESEARCH APPROACH

A research and development project was conducted to elaborate on the problems discussed above. A major point of departure of the project, which was called "A learning outcome model: Reflective assessment", is learning outcomes as part of the Bologna Process, and focusing on keywords such as knowledge, understanding, ability, skills, assessment, and perspectives. When applying learning outcomes to higher education courses, the need to assess student achievements in light of learning outcomes is considered to be a key issue. The use of learning outcomes has great potential, although it poses several challenges.

Assessing student achievements in the context of the present project calls for, among other things, the development of a framework. This framework would relate to learning outcomes from multiple perspectives, such as employability, student learning outcomes, research, and subject-oriented profiles. The project is grounded in and related to didactic practice and pedagogical research. Although the research and development project is conducted on the subject of information systems at four

Swedish universities, it is relevant to other subjects of a similar nature.

The research approach is qualitatively grounded in a case study (Yin, 1995), both in theory and in the knowledge areas identified by Kolb (1984), Tuckman (1965) and, finally, the Project Management Institute (2008). The context of this paper is an undergraduate course, which includes a development project at the Department of Management and Engineering, Information Systems, Linköping University, Sweden. Evaluations from the students were conducted at the beginning, in the middle, and at the end of the course

The results presented here are based on a recently created study that includes an IT project. The students' programme was restructured in 2008, and students can now choose between three different programme profiles—which is why this course was developed, designed, and implemented. This course, which is the students' second IT project course (their first was in their first year), is a ten-week undergraduate course. It was evaluated by both students and teachers, who focused on the learning outcomes. Evaluations were conducted at the beginning of the course, in the middle, and at the end. Three teachers and one assistant facilitated the students learning. Each of the teachers has at least fifteen years' teaching experience, and the course obtained highly positive evaluations from students.

3. THEORETICAL FRAME

Teachers can develop a deeper understanding of how learning outcomes can be used by drawing on knowledge from the project management area. The model in this paper is described from a general point of view; a project management tool (Stover, 2007) can be used to present all the stages in the model.

Considerable knowledge and practice can be applied in working with learning outcomes in project education, such as knowledge of project life cycle phases and the development of team member skills and knowledge (Cederling, Ekinge, Lennartsson, Taxén, Wedlund, 2000). The Project Management Institute (2008, p. 5) defines a project as "a temporary endeavour undertaken to create a unique product, service, or result". A project-oriented course normally comprises a range of processes, each of which contains certain stag-

es, steps, or phases; as such, this kind of course can be seen as a project.

Each phase comprises various activities, which are components of the work performed in the phase. A project-oriented course can therefore be divided into different time periods, often corresponding to the same phases as the generic project life cycle. The project life cycle defines the phases that connect the beginning of the project to its end. These phases make the project more measurable and manageable, which presents the following, five phases: project definition, project planning, project execution, project completion, and project evaluation. Project-oriented education (Wedlund, Axelsson, Melin, 2006) includes skills training, in which students improve their skills while completing the activities in the processes that are part of the course's project phases. These skills can be categorised as one of two types, depending on the decisions made about what activity to do and how to do it. This is also an important issue in industrial projects, such as those concerning global product development (Wedlund, 2000). Key considerations in project-oriented education include how teaching methods, project environment, and student learning backgrounds predict the quality of learning outcomes. Learning outcomes can be used when designing the course and completing course work. One purpose of a project-oriented course is to foster student-centred learning (Gibbs, 1995).

4. MANAGING LEARNING OUTCOMES - EXAMPLES

This section presents practical general examples of how a teacher can manage learning outcomes by using knowledge from the project management area. It is important to provide information about the intended learning outcomes for a course, and the learning opportunities that are available to the students. This information from the course means that teachers have to pay careful attention to curriculum and programme design and content. This paper uses empirical examples from the studied course. The beginning of the course is about two weeks long, followed by course execution, which takes about six weeks in this case. Finally, the course wraps up over a period of two more weeks.

The learning outcomes in the syllabus have been translated from Swedish into English, and

all nine learning outcomes of the course are presented in tabular form in Table 1.

Table 1. Learning outcomes in the course

Learning outcomes

After passing the course, students should be able to:

Identify various kinds of situation-adapted leadership in an IT project.

Analyse and design an IT system using object-oriented, unified modeling language (UML) design elements.

Understand the principles underlying object-oriented analysis and design.

Use IT support in implementing an object-oriented system.

Solve simple legal issues in an IT project.

Determine when legal expertise should be consulted in an IT project.

Use a language and set of concepts in explaining an IT project to leadership.

Deepen their knowledge within the chosen programme profile.

Present basic legal concepts concerning IT projects.

The three teachers of the course have developed and implemented the learning outcomes, and the students have evaluated the learning outcomes over the entire length of the course.

4.1. Analysing the learning outcomes

To gain an initial overview of what should be delivered in the course, the teacher starts by analysing the learning outcomes in the course. The teacher must be aware of why a certain learning outcome is in the syllabus, and what its purpose is. This concludes with a learning breakdown structure that represents an overview of everything that must be supplied at the end of the course, in so-called learning modules (Bevis, 1989). A learning module contains learning activities; when the students accomplish these learning activities, they will have attained the knowledge identified in the learning outcome. The learning module usually describes the nouns in the learning outcome.

In the course studied here, one of the learning outcomes states that:

"After passing the course, students should be able to identify various kinds of situation-adapted leadership in an IT project".

The learning modules in this learning outcome are based on the nouns, which in this case are situation-adapted leadership and an IT project.

By creating a learning breakdown structure, the teacher has broken down the deliverables of the course into smaller parts in order to gain an overview of all of the learning that needs to be completed by the students during the course. The teacher can do this by using creative methods such as "mindmapping". In this course, nine learning outcomes were broken down into learning modules.

4.2. Working with each learning module

Afterwards, the teacher starts working with each learning module, and breaks it down into different learning activities. These activities have to be sufficiently detailed. In this example (situation-adapted leadership, Hersey and Blanchard, 1984), there are different lectures for introducing knowledge on project organisation, project team composition, different roles within the team, communication profile models, development phases in the team, norms and rules, values and attitudes, project team rules, feedback, leadership, management, situational leadership, conflict resolution, and expectations and demands.

The students then start working on the IT project. In this case, the students are divided into project teams, each of which then choose at least three optional subjects that are covered in the lectures. The teams study these subjects in greater depth, and present the results orally and in writing at a workshop at the end of the second week. It is important to motivate the students and involve them in the learning outcomes as soon as possible. In this case, the students learn from their classmates in the project teams, creating a positive learning climate.

The project teams start working on the course project and engage in lab lessons, lectures, and exercises involving fundamental concepts of object orientation (see the Appendix for the other learning outcomes). The project teams start hands-on work on the various use cases involved in the shopping cart in the e-commerce website—the project.

4.3. Visualising the learning in the course

The work to develop a learning chart then begins (see Figure 1). The teacher must link all the learning modules and learning activities to each other, and the activities must sometimes be reconfigured, split up, or re-linked in order to meet the dates during the course. This work is often based on previous courses and experience.

The teacher should pay particular attention, however, to the integration of different learning activities from different learning modules. Assigning resources to the learning chart allows the teachers to notice practical problems for the students, as there can sometimes be practical conflicts between the resources.

This input provides a solid base for the detailed planning of the course. The students' individual learning processes are central during the course, and feedback, assessments and examination activities can be planned by using the learning chart. It is important that the students are motivated during the project, which is the carrier of new knowledge during the course. The students have learned a lot from the project and now have an opportunity for deeper learning (Gibbs, 1995). It is therefore important to involve the students in challenging tasks, some of which should be optional. There should also be the possibility of students obtaining a higher grade, such as passing with distinction. This is optional for the students, and in this course, the students must complete an individual project-related task.

Some of the students' learning should also be reflective. Students can reflect, for example, on the knowledge they acquired when starting and executing the course. The students should be able to display their learning results in both oral and written forms.

5. CONCLUSIONS

First, the teacher must design the course by using the learning outcomes set forth in the syllabus. The teacher starts by asking two questions:

"Why are these learning outcomes in the syllabus? What are their purposes?"

By answering these two questions, the teacher can clearly communicate the learning outcomes to the students and other teachers throughout the course.

5.1 Creating a learning breakdown structure

In the first stage of the model (creating a learning breakdown structure), all of the learning outcomes are divided into smaller parts, or learning modules. A learning module is a deliverable of learning from each learning outcome in the learning breakdown structure. This way of working is inspired of how to work with a work breakdown structure, in the project management area, and this example can also be used when working with a project management tool. Table 2 presents an example of a learning breakdown structure.

Table 2. Example of a learning breakdown structure

Course name, course code
Learning outcome
Learning module, notes and description
Learning module, notes and description
and so on
and so on ...

5.2 Defining learning activities

Second, the teacher should formulate a detailed strategy for facilitating the learning outcomes, which is done by using the learning packages and converting them into smaller parts, or learning activities. To this end, the teacher asks two questions:

“How can a student use learning activities during the course? What learning activities support a particular learning module for the student?”

When answering these two questions and deciding what type of learning activity to use, the teacher should consider the following factors (Wedlund, Axelsson, Melin, 2009):

- Student learning is based on prior experience
- Student learning is an active process
- Student learning should be organised using realistic projects
- Student learning should encompass multiple perspectives
- Student learning is unique to each student

The output of the second stage of the model (defining learning activities), is a so-called learning activity list. This list extends the de-

scription of the learning activity by identifying multiple attributes associated with each learning activity, such as the type of learning activity, learning activity duration, a detailed outline description for the learning activity, the predecessor's activities, the successor's activities, resource requirements, location, imposed dates, constraints, and assumptions. It is important that the learning activity is sufficiently described so that the teacher understands the learning that has to be performed.

5.3 Developing a learning chart

Finally, the teacher starts developing a learning chart by asking two questions:

“When should a student or a project team work on given learning outcomes, learning modules and learning activities? Who should work on these, a student or a project team?”

Team building and project team energy must be effectively managed by the teacher. Student learning is influenced by other students. The teacher must create a good learning climate, which should be done from the outset of the course. The teacher must then guide the students so that they can achieve the learning outcomes during course execution. This entails questioning the project team and providing feedback on an ongoing basis. After that, the students work individually via their learning processes, allowing them to deepen their learning.

The output in this third stage is a learning chart, which contains all the learning outcomes associated with the learning activities as well as the course schedule or timeframe. This chart, with bars representing learning outcomes and learning activities and their attributes, displays start and end dates as well as expected durations for the learning activities during the course. This is often the standard presentation for a project in a project management tool (see Figure 1 in the Appendix).

This paper has highlighted three stages in a model for working with learning outcomes: (1) creating a learning breakdown structure with learning modules, (2) defining learning activities including feedback, assessment and examination activities for the learning module, and (3) developing a learning chart. The teacher supports the students' active learning by working with these stages. This could be done by using a project management tool.

6. FINDINGS

Finally, the findings in this paper are that:

- The learning outcome could be structured as a learning cycle divided into learning activities and including feedback, assessment and examination activities for the learning module.
- Active learning is in focus in the learning chart, the students know what and when they are expected to learn during the course.
- Every learning outcome in the syllabus is presented, and the learning outcomes can then form the outline for the course.
- Knowledge from the field of project management is useful when switching focus from working with a timetable to a learning chart for a teacher. There are, for instance, document templates for different breakdown structures that could be used.
- It is important to have a project management tool when the teacher works with a model for learning outcomes. Such a tool can present the learning outcomes in a graphical way and use different views.
- It is an advantage to have only one software tool with which you can present all documentation in the course. This presentation can also be visualised as a website.
- A learning chart facilitates comparisons for the students learning with other universities.

The management of learning outcomes in the model for regular university courses needs to be further refined; evaluation, verification, and testing in regular course design are key aspects of this. Central analytical concepts could also be set forth in more mature forms and provided with a stronger basis in theory. For example, the results presented here could be related to frameworks for course design (Melin, Axelsson, Wedlund, 2009), theories of educational taxonomy by Bloom (1956), and instructional design theory by Merrill (1994).

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REFERENCES

- Bevis, E.O. (1982). *Curriculum Building in Nursing*. The C.V. Mosby Company, St. Louis.
- Bloom, B.S., Englehart, M.D., Furst, E.J., Hill, W.H., & Krathwohl, D.R. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals*. McKay, New York.
- Cederling, U., Ekinge, R., Lennartsson, B., Taxén, L., and Wedlund, T. (2000). A Project Management Model Based on Shared Understanding. *Proceedings of Management Minitrack in the Organizational Systems and Technology Track of the Thirty-Third Hawaii International Conference on System Sciences (HICSS-33)*, January 4-7.
- European Association for Quality Assurance in Higher Education (2005). *Standards and Guidelines for Quality Assurance in the European Higher Education Area*. DG Education and Culture, Helsinki, Finland.
- European Commission (2004). *ECTS Users' Guide: European Credit Transfer and Accumulation System for Lifelong Learning*. DG Education and Culture, Brussels, Belgium.
- Gibbs, G. (1995). *Assessing Student Centred Courses*. The Oxford Centre for Staff Development, Oxford.
- Hersey, P. and Blanchard, K. H. (1984). *The Management of Organizational Behavior*. Englewood Cliffs, N.J.: Prentice-Hall.

- Kolb, D.A. 1984. *Experiential Learning; Experience as the Source of Learning and Development*, Prentice-Hall, Englewood Cliffs.
- Marchewka, J. 2006. *Information Technology Project Management Providing Measurable Organizational Value*. John Wiley and Sons Ltd., New York.
- Melin, U., Axelsson, K. and Wedlund, T. (2009). Project-based Learning - An Emergent Framework for Designing Courses, *Information Systems Education Journal*, 7(34), <http://isedj.org/7/34/>, pp. 3-11. (Also appears in The Proceedings of ISECON 2006: §2144. ISSN: 1542-7382).
- Merrill, M.D. (1994). *Instructional Design Theory*. Educational Technology Publications, Englewood Cliffs, NJ.
- Project Management Institute (PMI) (2008). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 4th ed. Newtown Square, Pennsylvania, USA.
- Schwalbe, K. (2005). *Information Technology Project Management*. Thomson Learning, Cambridge, Boston, UK.
- Stover, T. (2007). *Microsoft Office Project 2007 Inside Out*. Microsoft Press, Redmond, Washington.
- Tuckman, B. (1965). Developmental Sequence in Small Groups. *Psychological Bulletin* 63, 384-399.
- Wedlund, T. (2000). Global Product Development Supported by Groupware. *Proceedings Product Models*, Linköping.
- Wedlund, T., Axelsson, K. and Melin, U. (2006). Project-Oriented Education: Managing Three Simultaneous Processes. *Higher Education Close Up 3 (HECU3)*, July 24-26, paper 42.
- Wedlund, T., Axelsson, K. and Melin, U. (2009). Learning Outcomes in Use - Project-Oriented Education from a Teacher's Perspective. *In The Proceedings of the Information Systems Education Conference 2009, v 26 (Washington DC): §1554*. ISSN: 1542-7382.
- Yin, R.K. (1995). *Case Study Research, Design and Methods* Sage Publications, Thousand Oaks CA.

Appendices and Annexures

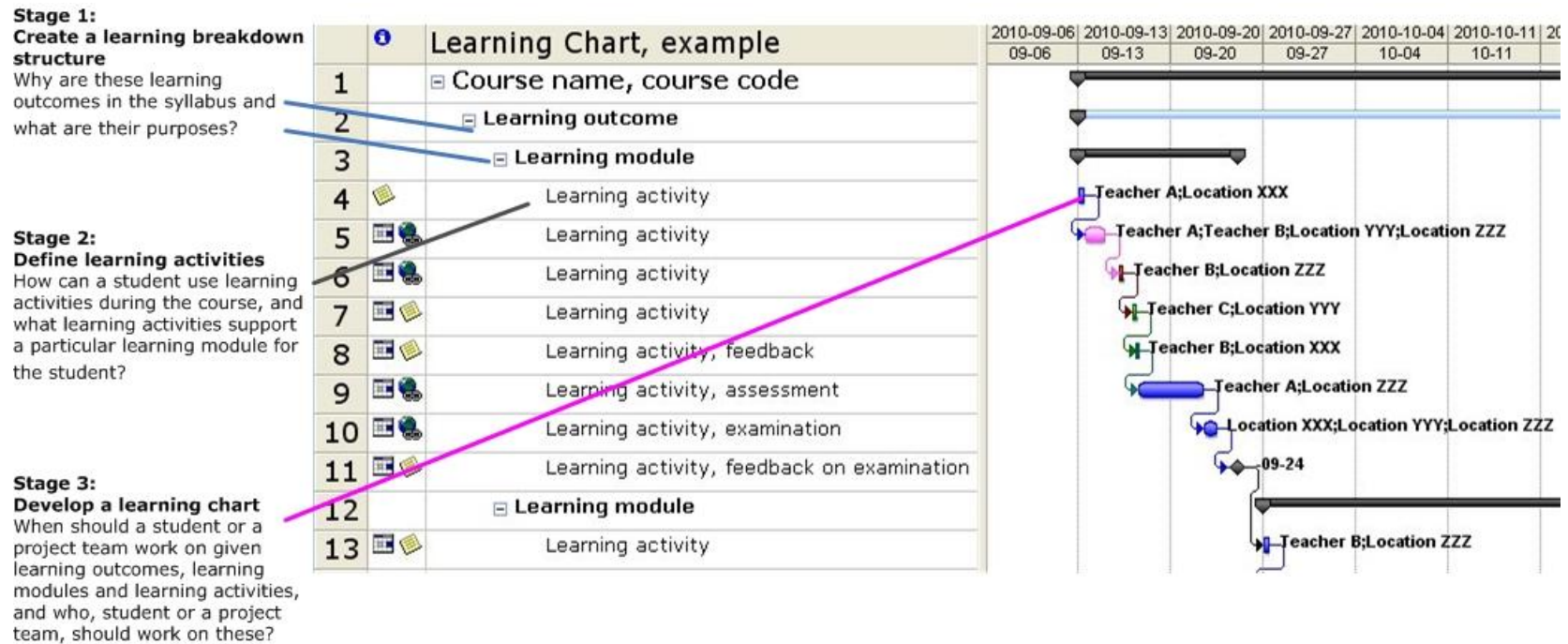


Figure 1. A learning chart example