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60

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The official language of the eLearning-2021 Conference is English. English will be used for all printed materials, presentations and discussion.

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FEEDBACK SUPPORTING DEEP AND STRATEGIC APPROACHES TO LEARNING AND STUDYING: A CASE STUDY ON PRODUCTION COST

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Abstract: *Feedback has one of the highest effects on learning. To benefit from its use, it should provide information important to students. This information may support activities applied in deep and strategic approaches to learning and studying. Bearing in mind that the production of quality feedback can be a costly enterprise, this paper examines the actual implementation cost of feedback techniques that provide such information. Although this cost may appear high at first sight, it becomes (much) lower if the developer task is consider as a "fill in a form" task because only modest extra work beyond the typical is needed. An example how this task might be done is included.*

Keywords: *E-Assessment, Feedback, Implementation cost, Learning approaches*

1. INTRODUCTION

Feedback has one of the highest effects on learning (e.g., [1]). To benefit from its use, feedback should provide information important to students (e.g., [2]). Bearing in mind the features of deep and strategic approaches to learning and studying – deep: "intention to understand, relating ideas, use of evidence, and active learning"; … strategic: "study organisation, time management, alertness to assessment demands, and intention to excel" ([3], p. 433) – this information (i.e. the feedback techniques providing it) may support activities applied in these approaches. For example, assessment feedback techniques regarding a deep approach may display (1) how certain questions from the test are related to the content which needed to be learned; and (2) which test contents are related to other contents that are studied in the course. Those regarding a strategic approach may show (1) a reminder of the most important facts about the knowledge and skills assessed by the test; and (2) student's individual results and the average result on completion of the knowledge tests.

Concerning e-assessment, our recent research focused on the importance of feedback techniques supporting activities applied in deep and strategic approaches to learning and studying [4, 5]. In the last study [5], ten feedback techniques were considered using a group of five techniques for each approach (for these techniques, see the Appendix). The examination of these techniques was done by students who assigned importance to each technique using a scale 0–10. A high average importance was assigned to both groups of techniques (above 7). This study also revealed that when the importance of all these feedback techniques was considered in a specific way, their potential relevance to achievement and motivation could be demonstrated. All these supported the claim that the use of this specific feedback based on learning approaches may result in certain learning benefits.

However, the production of quality feedback is usually a costly enterprise (e.g., [6]). This means that to have grounds to recommend the implementation of this specific feedback (i.e., feedback techniques supporting learning approaches that comprise it), apart from underlying possible learning benefits of applying it, consideration of its production cost should also be undertaken, hopefully resulting in a reasonable production cost. This contribution thus examines this cost in terms of the development time needed for feedback producation.

2. FEEDBACK PRODUCTION COST

To provide feedback to traditional test questions (multiple choice; true or false; and fill-in-the-blank with one word only), this study considered feedback techniques listed in the Appendix, whose production cost may at first sight appear as a costly enterprise, especially regarding feedback techniques D1–D5. However, if the test developer's task is

consider as a "fill in a form" task, the cost in question becomes (much) lower because only modest extra work beyond the typical is needed. In other words, to keep the cost in question reasonable, the test developer may use a form-based editor to enter and update certain feedback data, as is often done when certain information is best represented in a form-based format (e.g., [7]). Assuming the use of a form-based editor, the whole developer's work, including extra work, is described in the following paragraphs.

Typically, the developer has to enter the names of lessons, their parts, and learning objects comprising them; the descriptions of learning objects in terms of knowledge and skills involved; the content of questions used to assess these objects coupled with their correct answers. Enough for the assessment system to produce feedback techniques S2 and S3 provided that some basic statistics was already built-in in the system.

Assume that the value of each of these six attribute entered in a form are coded by the assessment system. Assume these codes for the second part of the third lesson are: L3, P3.2, LO3.2.1, LOD3.2.1, Q3.2.1.1, A3.2.1.1. Of course, there may be several learning objects (e.g., LO3.2.1, LO3.2.2, …, LO3.2.6), as well as several questions used to assess each of these objects coupled with their answers (e.g., Q3.2.1.1, A3.2.1.1; …, Q3.2.1.5, A3.2.1.5).

Some attributes (i.e. fields that accept their values) on this form are hierarchically arranged (i.e. a field hierarchy is present in the form). For example, when one learning object is selected (e.g., LO3.2.1), only questions assessing it are displayed (e.g., Q3.2.1.1, …, Q3.2.1.5). When one learning object is selected (e.g., LO3.2.1) and one question assessing it (e.g., Q3.2.1.5), the answer to this question is only shown (e.g., A3.2.1.5). In other words, assessment data need to be entered/updated/showed at different levels of granularity (e.g., [8]). Of course, for multiple choice questions, several responses to them, including correct ones are displayed.

By using such inheritance-keeping codes, feedback techniques D1 and S5 could easily be produced by the assessment system. How can this be done?

- Consider feedback technique D1. Assume it was applied to a 6-item test whose items were Q3.2.1, Q3.2.2, …, Q3.2.6 regarding three learning objects LO3.2.1, LO3.2.2, and LO3.2.3 (with two questions for each object). If answers to both questions regarding one learning object are correct, the underlying learning unit has been successfully mastered; otherwise it requires additional learning.

- Regarding feedback technique S5, the system can easily generate information similar to the following one: Assessment 1.1 regarding L1 (P1) includes LOD1.1.1, LOD1.1.2, and LOD1.1.3; Assessment 1.2 regarding L1 (P2) includes LOD 1.2.1, LOD 1.2.2., and LOD 1.2.3; etc. Of course, all these codes are replaced by the respective titles or descriptions.

The developer is required to undertake modest extra work to enable the production of feedback techniques D3, D4, S1, and S4. Let us finally briefly describe this extra work.

For these feedback techniques, each lesson part needs to be previously coupled with the content of four additional descriptors (e.g., P3.2.R – related learning objects; P3.2.D – way to implement from different point of view; P.3.2.R – reminder of the most important facts; and P3.2.L – what lessons appears before and after the current lesson). For D3, only codes of relevant learning objects need to be added (e.g., LO5.1.1, LO8.2.2). For S4, only codes of relevant lessons may be provided (e.g., before: L1, L2, L3; after: L5, L6, L7). For D4 and S1, only links to previously stored information may be added. Note that each additional descriptor may be considered as specific lesson feedback.

Although the content of the previous paragraphs contains many technical details (possibly confusing for those unfamiliar with software development), it is hopefully clear that the feedback techniques applied need to be connected to various assessment entities at different levels (whole course S5; lesson D4, D5, A1, S4; learning object D1; question D2). At present, general feedback can be provided for each question (e.g., S1), whereas specific feedback can be provided for one or several responses to it (e.g., D1), which is, for example, supported by Moodle, (https://docs.moodle.org/311/en/Quiz_settings).

* * *

To summarize: The previous examination showed that if test developer task is consider as a "fill in a form" task (provided that a suitable form-based editor supporting a field hierarchy was previously implemented in the assessment system), the cost in question becomes (much) lower than that perceived at first sight. This is because, as shown above, only modest extra work beyond the typical is needed. Also, in terms of development time, producing D1–D5 may not be considerably costly than that of S1–S5.

3. CLOSING REMARKS

Feedback has one of the highest effects on learning, and to benefit from its use, it should provide information important to students. Bearing in mind the features of deep and strategic approaches to learning and studying, this information (i.e. feedback techniques providing it) may support activities applied in these approaches. On one hand, the use of these techniques may have certain learning benefits. On the other, the production of quality feedback is usually a costly enterprise. Hence, before one recommends the implementation of this specific feedback, a consideration of its production cost should be undertaken. This consideration showed that if the developer task is consider as a "fill in a form" task, the production cost

would be reasonable because only modest extra work beyond the typical one is needed. However, a suitable form-based editor supporting a field hierarchy needs to be previously implemented in the assessment system. Furthermore, this form needs to enable one or more feedback techniques to be connected to various assessment entities at different levels (whole course, lesson, learning object, question). All these would increase (possibly not much) the overall production cost.

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Appendix – Feedback techniques supporting deep and strategic approaches to learning and studying

Deep approach

D1 – Information is obtained about areas that I have successfully mastered in the current knowledge test versus areas that require additional learning.

D2 – A link is given to a file whose content shows how certain questions from the test are related to the content which needed to be learned.

D3 – A link is given to a file whose content indicates which test contents are related to other contents that are studied in the course.

D4 – A link is provided to a file whose content indicates how knowledge and skills that are the subject of the test can be implemented from different point of view.

D5 – Information is obtained about which areas in the current knowledge test I could receive special learning assistance for from the professor.

Strategic approach

S1 – A link is provided to a reminder with the most important facts about the knowledge and skills assessed by the test.

S2 – Information is obtained about how successful I was in solving the tasks in relation to the success of other students who had already solved the test.

S3 – Information is given about my individual results and the average result on completion of the knowledge tests.

S4 – A link is given to a file that, according to the order of presentation, locates the part of the course (lesson) that is the subject of the test in relation to other parts that appeared or will appear in other tests.

S5 – Information is obtained about the order in which individual knowledge and skills will be assessed at tests that should be completed during the semester.

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