Students' Satisfaction of a Design Thinking MOOC with Personalized Learning Objectives

Tobias Rohloff
Hasso Plattner Institute
Potsdam, Germany
tobias.rohloff@hpi.de

Karen von Schmieden
Hasso Plattner Institute
Potsdam, Germany
karen.schmieden@hpi.de

Christoph Meinel
Hasso Plattner Institute
Potsdam, Germany
christoph.meinel@hpi.de

***Abstract*—Due to their openness and low barriers to enroll, most Massive Open Online Courses (MOOCs) offer free access to knowledge for almost everyone. This attracts a large number of learners, each with their own individual intentions and motivations to join a course. However, personal support and guidance can almost never be provided at this scale. All learners have to follow the same usually weekly structured content and the learning success is only measured by the achievement of a certificate. To overcome this one-size-fits-all approach with technical means, we introduced a tool for Personalized Learning Objectives. This enables learners to achieve more individual objectives in courses, follow different learning paths, and link their motivations and intentions to the definition of learning success. Previous studies have already examined, among other aspects, the usefulness, acceptance, and achievement rates of learning objectives in MOOCs. In this complimentary research, the satisfaction of students with and without a selected learning objective is compared in a course on topics from the field of Design Thinking.**

Keywords—MOOCs, Learning Objectives, Goal-Oriented Learning, Self-Regulated Learning, E-Learning

I. INTRODUCTION

The digital learning format of Massive Open Online Courses (MOOCs) has the capability to create virtual educational experiences for tens of thousands of students, leading them to complete a course over a period of usually several weeks. In order to cope with this scale, the possibilities of a personalized learning experience and outcome are limited, as individual supervision is only possible to a very limited extent. This conflicts with the different motivations and intentions to join and complete a course that such a diverse community of learners brings with it, as they can have very different social, cultural and geographical backgrounds. Usually, all students are guided through the same weekly structured content that they have to work on themselves [1]. A successful completion of the course is typically defined by achieving a certificate, which is reasonable from the perspective of the course provider. However, studies have shown that learners in MOOCs have very different learning goals and a certificate is only one of many different desired learning outcomes [2], [3]. Therefore, the current one-size-fits-all approach needs to be reconsidered.

Especially in MOOCs where personal support and guidance are often limited, goal-oriented and self-regulated learning are important factors for individual learning success since they have been recognized as valuable skill sets due to their positive influence on and students' achievement [4], [5]. However, technical adaptations to support and encourage learners in these metacognitive skills are very rare [2], [6]. Therefore, in previous studies we have introduced and implemented the concept of Personalized Learning Objectives in MOOCs to enable learners to achieve more individual objectives in courses and follow different learning paths [7], [8], [9]. This aims, in particular, to better meet the diverse learning needs and to link the definition of learning success to the motivations and intentions of the students. In addition to the technical feasibility and the highest possible degree of automation, we investigated the acceptance and usefulness as well as the selection and achievement rates of Personalized Learning Objectives in MOOCs. A survey showed that 69% of the learners considered the selection of an objective as useful and 63% stating that it helps them to achieve their personal goals. Furthermore, no practically relevant differences could be identified as to which users select learning objectives according to their socio-demographic and geographical background. Besides, we have found a practical significant improvement in certification rates when we compared the entire course population and the students who chose an objective with a graded certificate.

To complement these previous works, in this paper we examine the students' satisfaction of a course in which methods of Design Thinking were taught. Design Thinking is a user-centered approach for problem-solving and idea development. In comparison to the IT-themed MOOCs we formerly examined with regard to Personalized Learning Objectives, this course focuses on design and user experience skills. We might thus draw a different learner community with a more articulate need for Personalized Learning Objectives: practitioners might take the course to brush up on skills, are only interested in modular topics of the course, or would like to be inspired by the course design. In order to assess statistical and practically relevant differences, we have investigated the following research question:

Are students who selected a learning objective more satisfied with the course than those who have not selected an objective?

To answer this question, we first explain the term learning objective in Section II. We then present the research methodology in Section III, with regard to (A) the design of the study and the implementation of the learning objectives feature on the platform; (B) key figures, structure, and learning objectives of the course; as well as (C) the collected data and the methods for evaluation. Afterward, Section IV presents and discusses the results, and at last, Section V concludes the paper.

II. DEFINITION OF LEARNING OBJECTIVES

In this work, the following definition of learning objectives is applied to all occurrences of the terms goals and objectives. A learning objective has a concrete focus and

978-1-7281-9728-9/20/$31.00 ©2020 IEEE

describes specific and discrete units of knowledge and skills that are needed. These objectives are the result of short-time activities that can be achieved through a certain number of steps. Consequently, they are specific enough to be observable and measurable [10], [11]. In pedagogy, learning objectives are typically classified and created using models such as the (revised) taxonomy of Bloom [12]. Another well-known approach to defining objectives is the acronym *SMART*—objectives should be specific, measurable, achievable, relevant and time-bound [13].

As explained in [8] and [9], MOOCs usually group their content according to specific topics and cover various smaller thematic units. In contrast to the predominant orientation towards the completion of the course, individual objectives can be understood as the completion of certain parts of the course material. Therefore, we define the completion of these thematic units as the basis for learning objectives, as they represent the smallest unit of knowledge conveyed within a course. It is possible to verify the acquired knowledge through the exercises provided. Besides, personalization is achieved by offering different didactically appropriate objectives per course, which are created by the teaching team and from which the learner can choose one and follow it individually if desired. Three types of objectives were implemented and integrated into the HPI MOOC platform: (1) receiving a graded certificate, called Record of Achievement, for course completion; (2) receiving an ungraded certificate, called Confirmation of Participation, for consuming a specific proportion of the learning material; and (3) different thematic units can be derived and offered as learning objectives based on selected knowledge acquisition and knowledge examination items.

III. Research Methodology

This section presents the study design including the learning objectives feature, key characteristics of the investigated course, and the collected data and the methods used to analyze them.

A. Study Design

The technical prototype for Personalized Learning Objectives used in this study was implemented and piloted in [8] and [9] for the HPI MOOC platform. Detailed technical and conceptual information can be taken from these works. In this section, we summarize the core functionality from the user's point of view to explain the context of this work in a comprehensible way. After the teaching team has created learning objectives for a course, three functionalities are available to the students: The learning objective selection, guidance, and evaluation.

1) Objective Selection

The selection of a learning objective is offered to the user as an option when she or he accesses the course material for the first time. A modal[1] is displayed (Fig. 1) which can be dismissed without selecting a learning objective and never appears again automatically to not disturb the user. If the user wants to select a learning objective at a later time, the modal can be manually reopened from an infobox at the top of the learning items page or the progress page. At the latter, the learning objective can be changed at any time. The infobox disappears as soon as the user has selected a learning objective or dismissed it.

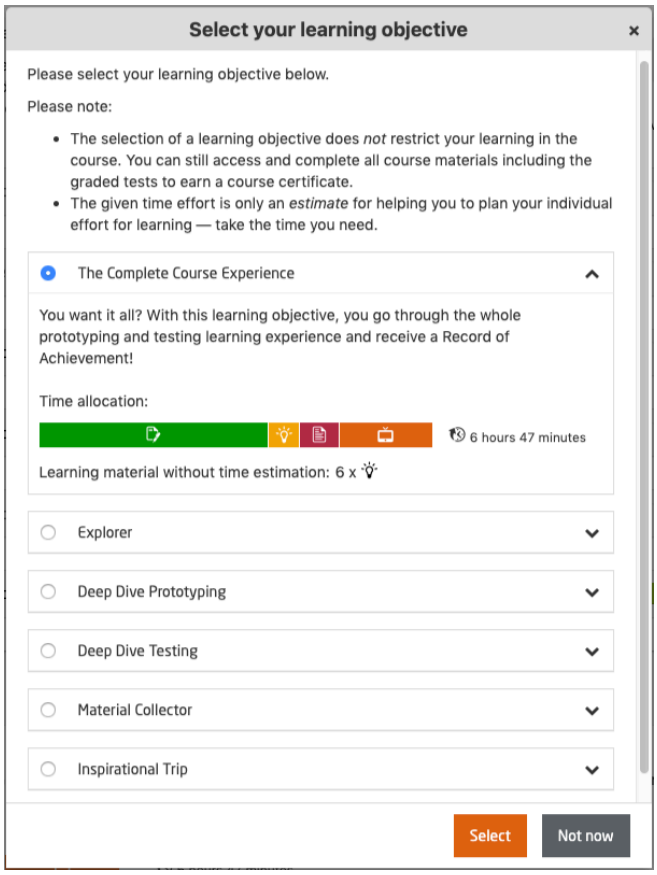

Fig. 1. Objective Selection Modal

The modal provides information about how the learning process is affected when one is selected. A short title is displayed for each learning objective and a detailed description can be expanded. In addition, an estimated time effort is displayed for the entire learning objective and accumulated for all item types it contains. This information should help the user to make an informed decision and to compare learning objectives more easily. After selection, a short confirmation is displayed and it is explained how the user will be guided through the learning items of the objective.

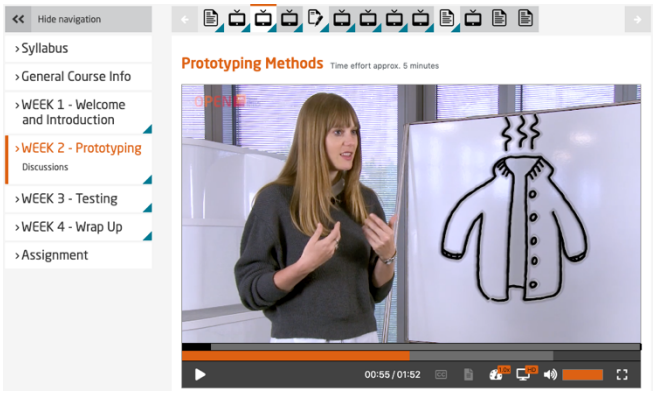

Fig. 2. Objective Guidance

[1] A graphical overlay window also called dialog or pop-up.

2) Objective Guidance

In order to identify learning items that belong to a learning objective as easily as possible, they are marked with a blue triangle in the navigation as shown in Fig. 2. A tooltip is also displayed when hovering the navigation items. This enables users to see where they should start with their objective and what content they should focus on. As shown, the regular course structure is still maintained and the implemented approach of guidance does not restrict the user in accessing the other content. This also allows users to do more than initially intended and exceed their original objective.

3) Objective Evaluation

To enable users to evaluate the progress and achievement of their learning objectives at any time, the progress page has been adapted for courses on the platform (Fig. 3). It shows the overall progress of the course as well as the progress of the selected learning objective. It also displays the points required and achieved as well as the visited learning items to complete a learning objective. In addition, for each section of a course, the individual learning items belonging to the learning objective can be grouped separately to show their detailed progress. This allows the learners to pursue their objective but also to discover the other course material. Overall, this page should help to raise awareness and enable users to track their progress. Below this part, the currently selected objective is displayed and can be changed at any time.

B. Course Characteristics

The evaluated course was held on openHPI, our institute's instance of the HPI MOOC platform. All courses are free of charge, available to everyone, and are mainly based on the curriculum of the Hasso Plattner Institute (HPI). The course, Human-Centered Design: Building and Testing Prototypes (abbreviated *prototype2019*), covered different task-based approaches to turn an idea into a simple prototype, set up a testing scenario, and collect feedback—based on the methodologies of Design Thinking. The course was held in English and ran from August 28, 2019, to October 10, 2019. 3,029 students were enrolled at the start of the course. It was divided into 4 weeks and was graded with three exercises (40% of all points) and a peer assessment (60% of all points). Two types of certificates could be gained: First, a Confirmation of Participation was achieved by about 40% of all shows-at-middle[2] by completing at least 50% of the course material. Second, a Record of Achievement was gained by about 16% of all shows-at-middle by earning more than 50% of all graded points. The Personalized Learning Objectives in this course build on user behavior observations from previous Design Thinking MOOCs: the research team observed participants who only explored partial modules of the course or browsed course contents for educational material to download. The teaching team offered the following six learning objectives, from which the learners could choose one:

1. *Complete Course Experience*. This objective comprised all course material including the graded exercises and the peer assessment to gain a Record of Achievement.
2. *Explore*. This objective comprised all introductory material about design thinking, prototyping, and testing. Following the objective sufficed to receive a Confirmation of Participation.
3. *Deep Dive Prototyping*. This objective focused only on content about prototyping.
4. *Deep Dive Testing*. This objective focused only on content about testing.
5. *Material Collector*. This objective highlighted the material items for users who were mainly interested in collecting resources and templates.
6. *Inspirational Trip*. Learners who did not know whether the course is interesting for them or not could choose this objective to take a look at the course.

C. Data and Analysis

To gather information on the students' satisfaction with the course, a post-course survey was conducted in week four, in which students could participate voluntarily. There were a total of 279 complete submissions regarding the assessed questions, 163 from students without a selected learning

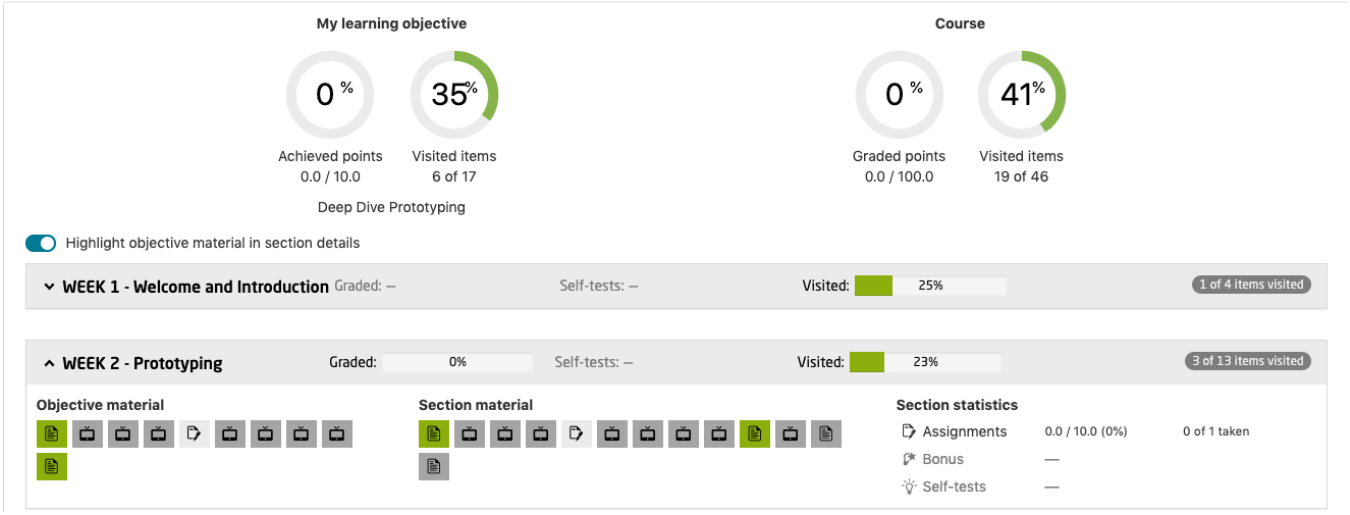

Fig. 3. Objective and Course Progress

[2] Students who visited at least one learning item by course middle.

objective and 116 from students with a selected learning objective. The first four questions could be answered with the use of a Likert-scale, with answer options from *not satisfied at all* (1) to *absolutely satisfied* (10). The questions were:

1. Please rate this MOOC by indicating how satisfied you are with the overall course.
2. How satisfied are you with the quality of the content presented in the course?
3. How satisfied are you with the length of the course?
4. How satisfied are you with the openHPI learning platform?

After that there was a single-choice question with the answer options *no* (1) and *yes* (2):

5. Were your personal learning expectations met?

Based on the numerical value of each answer option, we compared both user groups for statistically significant differences utilizing the nonparametric Mann–Whitney *U* test for two independent samples. We also assessed the practical relevance of the descriptive statistics, based on the authors' long-term experience with the operation of several MOOC platforms and courses.

IV. Results and Discussion

Before we discuss the results of the statistical analysis of the course satisfaction in this section, we first review the learning success of the survey respondents. Many users drop out of a MOOC during its runtime for a variety of reasons. Therefore, when surveys are conducted at the end of a course, it is usually only the most engaged and successful learners who have made it to this point who participate. Therefore, we want to assess the extent to which a survivorship bias may influences the results of the survey.

Table I shows the number of certificates achieved by the shows-at-middle of the entire course, i.e., the users who had a realistic chance of receiving a graded certificate, and the survey respondents. It can be seen that the survey respondents have gained a much higher number of Records of Achievement (76.70%) than the shows-at-middle (15.94%). In addition, all survey respondents achieved a Confirmation of Participation. Only 39.91% of the shows-at-middle achieved this.

TABLE I. Achieved Certificates

Cohort	Count	Records of Achievement	Confirmations of Participation
Shows at Middle	1568	250 (15.94%)	626 (39.92%)
Survey Respondents	279	214 (76.70%)	279 (100.00%)

Table II displays the selected learning objectives and achievement rates of the shows-at-middle and survey respondents. In both cohorts the clearly most frequently selected learning objective is the *Complete Course Experience* which includes the completion of a Record of Achievement (71.88% and 83.63%). Also in these subsets, the survey respondents reached the learning objective far more often (83.51%) than the shows-at-middle (28.57%). The second most frequently selected learning objective is *Explore* which includes the achievement of a Confirmation of Participation (14.73% and 11.21%). All survey respondents completed this objective, but only 46.97% of the shows-at-middle. The other topic-based learning objectives were selected far less frequently, especially by the cohort of survey respondents. A more detailed analysis with a focus on the achievement rates of the learning objectives was conducted in [9].

TABLE II. Selected and Achieved Learning Objectives

Objective	Type	Shows at Middle			Survey Respondents		
		N	Quota	Achieved	*N*	Quota	Achieved
Complete Course Experience	RoA	322	71.88%	28.57%	97	83.62%	83.51%
Explore	CoP	66	14.73%	46.97%	13	11.21%	100.00%
Deep Dive Prototyping	Topic	31	6.92%	19.35%	3	2.59%	100.00%
Deep Dive Testing	Topic	4	0.89%	0.00%	0	0.00%	-
Material Collector	Topic	3	0.67%	0.00%	0	0.00%	-
Inspirational Trip	Topic	22	4.91%	18.18%	3	2.59%	66.67%

The examination of the results in Table I and II has shown that the survey respondents have clearly better learning outcomes than the course population, measured by the shows-at-middle, both in terms of the traditional completion with a certificate and in achieving Personalized Learning Objectives. It must therefore be assumed that the answers of the survey respondents are subject to a survivorship bias and that this shifts the overall course satisfaction into a more positive direction.

The results of the questions examined in the survey are shown in Table III. The respondents were divided into users with (N = 116) and without (N = 163) a selected learning objective. It can be seen that the overall course satisfaction (Question 1) is almost the same for both cohorts (8.422 and 8.441). The satisfaction with the quality of the course content (Question 2) was slightly better perceived by users with a selected learning objective (8.5 and 8.404). This trend may be due to the fact that relevant content is better highlighted for users with learning objectives. Interestingly, users without learning objectives are a little more satisfied with the length of the course (8.172 and 8.404) which was asked in Question 3. This could be explained by the assumption that users who choose a learning objective are more likely to have a specific focus in the course and are not interested in the whole content, which is supported by the concept of Personalized Learning Objectives. In Question 4 users were asked for their overall satisfaction with the learning platform and both cohorts show

TABLE III. Descriptive and Inferential Statistics for Survey Respondents With and Without a Selected Learning Objective

Question	With Objective			Without Objective			Mann-Whitney *U*	
	N	Mean	Std.Dev.	*N*	Mean	Std.Dev.	*U*	*p*
1	116	8.422	1.610	163	8.441	1.461	9342.5	0.862
2	116	8.500	1.568	163	8.404	1.573	9115.0	0.597
3	116	8.172	2.022	163	8.404	1.780	8887.0	0.378
4	116	8.474	1.917	163	8.582	1.756	9242.0	0.739
5	116	1.939	0.239	163	1.914	0.281	9212.5	0.426

very similar positive results (8.474 and 8.582). The same applies to Question 5, in which users were asked whether their personal learning expectations were met (1.939 and 1.914).

Overall, the generally very positive results show no statistically significant differences between the two cohorts based on the calculated *p*-values. Furthermore, we cannot derive any practical relevance from the very small differences. It should also be noted that the very positive results are distorted by a proven survivorship bias. The research question can therefore be answered to the effect that in the Design Thinking MOOC studied, students with a selected learning objective are no more, but also no less satisfied with the course than students without a selected learning objective.

V. Conclusion

Based on previous works on the implementation of Personalized Learning Objectives in MOOCs [8], [9] this paper presented a complementary study on students' satisfaction of a course about Design Thinking with a focus on design and user experience skills. The selection and achievement of learning objectives should enable users to pursue their individual intention and motivation to enroll in an open online course. This should also contribute to detach the definition of learning success in such an open format from the achievement of certificates. This new type of learning tool in MOOCs has already been examined with regard to its acceptance and usefulness, as well as the achievement rates of the learning objectives.

We compared the course satisfaction of students with and without a selected learning objective with self-reported data from a post-course survey. First, we demonstrated a positive shift in the results through a survivorship bias of the survey respondents, which is relevant in assessing the overall perception—that in fact turned out to be notably positive. Second, we compared both cohorts. We could not find any statistically significant differences, nor could we derive any practical relevance. Therefore, students with a selected learning objective are no more, but also no less satisfied with the course than students without a selected learning objective. It is interesting to note that this tool—to better support self-regulated and goal-oriented learning—does not seem to have any impact on the general course satisfaction, but usefulness and achievement rates were perceived and influenced positively in previous studies. To investigate causality, more qualitative studies are necessary.

References

[1] A. Margaryan, M. Bianco, and A. Littlejohn, "Instructional quality of Massive Open Online Courses (MOOCs)," in Computers & Education, vol. 80, pp. 77–83, January 2015. DOI: http://dx.doi.org/10.1016/j.compedu.2014.08.005

[2] R. F. Kizilcec, and E. Schneider, "Motivation as a Lens to Understand Online Learners: Toward Data-Driven Design with the OLEI Scale," in ACM Transactions on Computer-Human Interaction, vol. 22, March 2015. DOI: http://dx.doi.org/10.1145/2699735

[3] S. Zheng, M. B. Rosson, P. C. Shih, and J. M. Carroll, "Understanding Student Motivation, Behaviors and Perceptions in MOOCs," in Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15), pp. 1882–1895, February 2015. DOI: http://dx.doi.org/10.1145/2675133.2675217

[4] J. Broadbent, and W. L. Poon, "Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review," in The Internet and Higher Education, vol. 27, pp. 1–13, October 2015. DOI: http://dx.doi.org/10.1016/j.iheduc.2015.04.007

[5] M. Henderikx, K. Kreijns, and M. Kalz, "Refining success and dropout in massive open online courses based on the intention-behavior gap," in Distance Education, vol. 38(3), pp. 353–368, September 2017. DOI: http://dx.doi.org/10.1080/01587919.2017.1369006

[6] D. Lee, S. L. Watson, and W. R. Watson, "Systematic literature review on self-regulated learning in massive open online courses," in Australasian Journal of Educational Technology, vol. 35(1), March 2019. DOI: http://dx.doi.org/10.14742/ajet.3749

[7] T. Rohloff, and C. Meinel, "Towards Personalized Learning Objectives in MOOCs," in Lifelong Technology-Enhanced Learning, pp. 202–215, August 2018. DOI: https://doi.org/10.1007/978-3-319-98572-5_16

[8] T. Rohloff, D. Sauer, and C. Meinel, "On the Acceptance and Usefulness of Personalized Learning Objectives in MOOCs," in Proceedings of the Sixth (2019) ACM Conference on Learning @ Scale (L@S '19), June 2019. DOI: http://dx.doi.org/10.1145/3330430.3333624

[9] T. Rohloff, D. Sauer, and C. Meinel, "Students' Achievement of Personalized Learning Objectives in MOOCs," in Proceedings of the Seventh (2020) ACM Conference on Learning @ Scale (L@S '20), August 2020. DOI: http://dx.doi.org/ 10.1145/3386527.3405918

[10] P. R. Pintrich, "The Role of Goal Orientation in Self-Regulated Learning," in Handbook of Self-Regulation, pp. 451–502, 2000. DOI: http://dx.doi.org/10.1016/B978-012109890-2/50043-3

[11] D. E. Steere, and D. Cavaiuolo, "Connecting Outcomes, Goals, and Objectives in Transition Planning," in Teaching Exceptional Children, vol. 34(6), pp. 54–59, July 2002. DOI: http://dx.doi.org/10.1177/004005990203400608

[12] D. R. Krathwohl, "A Revision of Bloom's Taxonomy: An Overview," in Theory Into Practice, vol. 41(4), pp. 212–218, 2002. DOI: https://doi.org/10.1207/s15430421tip4104_2

[13] G. T. Doran, "There's a SMART way to write management's goals and objectives," in Management Review, vol. 70(11), pp. 35–36, 1981.