Walking on 2 Legs: 3D-Structured Method Alignment in Project Management

Christian Stary(✉)

Department of Business Information Systems – Communications Engineering, Johannes Kepler University, Altenbergerstraße 69, 4040 Linz, Austria
Christian.stary@jku.at

Abstract. This paper explores the possibility of the use of tangibles in the field of education and project management. We propose an interactive instrumentation based on specific building blocks referred to as W2L (Walking on 2 Legs) that can be used as a (pedagogical) practice to guide and facilitate method structuring and alignment in project design. The need for this instrumentation is motivated by a teaching approach where students are asked to select, assign, and adjust methods pertaining to a specific project design. In order to improve their respective skills, we have designed and implemented W2L for method chaining along project phases or milestones using Lego© bricks and adapting a table-top system. We could test W2L with Knowledge Management students when planning their project to evaluate the effectiveness of the approach. An analysis of feedback and results revealed positive impact on methodologically informed project design.

Keywords: Project planning · Methodological design · Gamification Lego© · Tangibles · Tabletop interaction · Articulation support

1 Introduction

Project management has become essential in education, as business and management require respective skills increasingly (cf. [12]). Traditional courses explore a systems approach to the selection, design, execution, control, evaluation, and termination of projects to meet project objectives and customer expectations within allocated performance and resources constraints in organizations (cf. [5]). Basic tools and techniques of project management that are explored place emphasis on management and engineering tasks, as the courses have the goal to facilitate the knowledge that will aid project leaders to successfully handle project-specific work structures and achieve a project goal within an certain time and cost frame. Hence, typical course objectives are: Understand essentials of project management and apply the fundamental tools and its methods; Develop knowledge of concepts and methods in the leadership of projects; Perform conceptual design, planning, and scheduling for a project; Develop knowledge for understanding, assessing, and resolving human, technical and administrative issues for deployed projects. The format leading to demonstrate student capability in design, analysis, and evaluation of project management (systems) is traditionally based on (blended learning) class and self-regulated periods. Besides studying (electronical) text and handout material, students take part in class discussions and work on assignments

A. L. Brooks et al. (Eds.): ArtsIT 2017/DLI 2017, LNICST 229, pp. 33–42, 2018.
https://doi.org/10.1007/978-3-319-76908-0_4

including practical project work. Thereby, lecture material, deliverables, project presentations, and reports are discussed.

Since project management has its focus on organizing, planning, monitoring, and controlling project-specific information and activities, the teacher is used to ask the students to develop a project plan, perform a project, and evaluate the results according to the project's objectives. Testing these skills involves students to get an idea of taking responsibility and to collaborate with other students or project workers according to the project plan while minimizing risks to ensure successful project completion (cf. [7]). Although this approach insists that students become firm in management activities, learning to know how to take responsibility and collaborate needs to be enriched to the dynamics of today's organizations' operations and domain-specific context (cf. [6]). As the study of Lakemond et al. [8] reveals for innovation projects, the flow of knowledge becoming crucial, requiring to put project management in knowledge-management context - the organization's knowledge governance, and thus, core asset matters for the integration of external knowledge into innovation processes.

Becoming aware of opening project management to its application domain and domain-specific objectives motivated us to think about building a tangible interactive support instrument for more informed, enjoyable and lasting experience of selecting and arranging problem-solving methods to meet project objectives. It should focus on increasing the level of involvement using hand gestures and playful elements where achieving a project objective through method alignment even in complex settings is a structured task. In the following, we report on the development of a pedagogical technique to learn method chaining through a structuring mechanism. We performed aspiration and ideation tasks providing a natural user interface and a set of building blocks to students in Knowledge Management. The instrument we have finally implemented enriches conventional project management settings by providing 3D elements and a set of relationships relevant for method application and alignment. It is of use when arranging and completing a chain of methods in a tangible way along project planning and design.

Due to the exploratory nature of research, we followed the design thinking process as proposed by the Stanford D.school (dschool.stanford.edu) when developing the instrument. The process comprises inspiration, ideation, and implementation. After defining the challenge, forming the team and conducting a secondary research it is the inspiration phase where the team conducts the design research that can be considered the core of all the news phases. By the end of this phase, researchers should have a clear understanding about the design challenge to be addressed, aside of a project plan for the timeline, budget, and team. This stage is crucial to ensure the success of the project as it is considered a pivot point where the different stages need to refer to during the measurements and iteration after each of the ideation and implementation phases. In this paper we report on:

- The *inspiration phase* identifying concrete needs and relating project management activities to method structuring and alignment.
- The *ideation phase* driven by students, with design proposals emerging from Lego©-based structuring and aligning methods when planning projects in Knowledge Management.

- The *implementation* of a tangible instrumentation that involves the students to use 3D elements, hand gestures, and visual stimuli to actively participate in the method specification and chaining of a project design process.

The remainder of this paper is organized as follows: In Sect. 2, we describe how the design emerges through revisiting method chaining in the context of project management (inspiration phase), and students dealing with Lego© bricks for method selection, specification, and concatenation (ideation phase). In Sect. 3, we discuss the proposed methodology, and present the setup for interactive manipulation. We also report on feedbacks from first field tests (implementation phase). Section 4 concludes the paper with future directions of research.

2 Emergent Design

In this section we detail the inspiration phase identifying concrete needs and re-considering existing work for a specific application domain, namely Knowledge Management (KM), in Subsect. 2.1, before reporting on the ideation phase driven by stakeholders, with designs emerging from experiments involving KM students in Subsect. 2.2.

2.1 Method Alignment in Knowledge Management Project Design

Project management in Knowledge Management (KM) is similar complex to innovation management, the case mentioned in the introduction. Knowledge managers as project managers need to be aware of techniques and tools handling stakeholder knowledge to become effective for organizations and their development [1]. Project design is driven by several constituents, most important, theories and conceptual frameworks, such as the Knowledge Life Cycle [3], and a set of methods addressing the various KM dimensions, such as Repertory Grids for externalizing implicit knowledge (cf. [4]).

Theories and concepts set up frameworks and lifecycles. They provide the context of methods and their application. The more theoretical underpinnings and conceptual knowledge about methods can be provided, the better KM activities can be set in a coherent way. However, theories or concepts can evolve without being linked explicitly to methods (cf. [14]). For instance, systems thinking [13] is not bound to a certain method. It can be applied in various contexts, and thus implemented by a variety of methods.

When acquiring methodological knowledge KM project managers need also to become aware of specific bundles of KM activities: Acquisition, representation, sharing, processing, and evaluation. They have been introduced to structure knowledge conversion processes, as e.g., proposed by Nonaka and Takeuchi [9]. When planning a KM project, for each of those activity bundles, methods fitting to the inherent KM logic need to be specified and aligned, e.g., knowledge representation follows knowledge acquisition for documenting and storing generated knowledge.

In Fig. 1 some constitutive KM elements are exemplified according to the aforementioned categories. Since theories and concepts play a crucial role for putting KM into reflective praxis and affect operational activities, they have been separated (left strand in the figure) from activity bundles (middle strand) and methods (right strand). Figure 1 also shows typical instances of KM theories and concepts (naming some KM proponents), activity bundles, and methods.

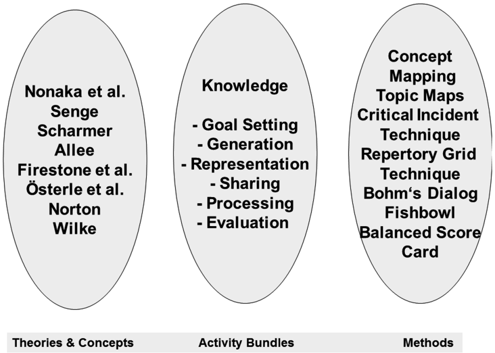

Fig. 1. Sample KM theories and concepts, activity bundles and methods

In addition, project managers have to be aware that methods primarily focus on a certain perspective, such as the Balanced Score Card focusing on financial matters. However, a KM project typically touches several perspectives, including technology, organization of work, social behavior, emotions, and cognition. Whenever a method is applied, the perspective determines the subject of concern, which adds an additional challenge to the selection and alignment process.

A KM project requires to consider each KM strand in an adjusted and mutually aligned way, in order to ensure coherent project settings. An informed setting in this way should prevent reductionist method applications or incomplete project task procedures. Consider an application of Value Network analyses (cf. [15]) without any background on converting implicit to explicit knowledge: It could easily mislead a KM project, e.g., reducing its outcome to codified organizational assets when focusing on tangible elements. Another common example concerns single and double loop learning processes (situated in Theories & Concepts in Fig. 1), as neglecting double loop processes could hinder changing the processing environment (single loop learning). Such lack of scoping restricts organizational value creation through KM projects, and can be prevented by adjusting knowledge generation, representation, and processing in an informed way (cf. [16]).

Finally, it needs to be noted that specific methods may require understanding their respective background and origin, in order to put them to practice effectively. For instance, Repertory Grids [4] open up for the individual exploration of mental models. Albeit gaining individual insights, further (social) interventions are required in the course of subsequent KM activities, such as sharing and consolidating grids, before the acquired knowledge can be processed for organizational change. Hence, the epistemic structure of KM requires informed method selection and mutual alignment in the course of project planning and design.

2.2 Method Alignment Using Lego© Bricks: Starting to Walk on 2 Legs

As indicated above, project management, in particular project planning and design in Knowledge Management (KM) is a non-trivial task. Thereby, project managers need to be aware of KM methods and their context of use to achieve KM project goals. Since we wanted to develop an educational and effective support tool, the students of the postgraduate KM program at the University of Linz were asked to perform a project planning task, including milestone definition and method specification for each project phase. Typically, a KM project starts with the some method application eliciting or acquiring knowledge from domain experts or informed stakeholders, and is followed by documenting acquired knowledge in some repository using a knowledge representation scheme. Each of these tasks needs to be supported by (a federated set of) methods, with interfaces enabling non-disruptive processing and seamless exchange of data. Hence, each method application needs to be checked in how far it fits into the resulting method chain for the project at hand.

In order to identify effective means to support the method specification and alignment process, the KM students were given a set of various Lego© bricks. They were asked to encode and visualize the structuring and alignment of methods according to their project tasks using these bricks in a modular manner. Thereby, they needed to take into account the following constitutional information concerning methods:

1. ***Incoming and processed information***: We distinguish the trigger referring to the starting point of a method application from the data to be provided as input, since both are relevant items of project management.
2. ***Functional processing or core information***: It specifies not only the name of the method and thus, the function in terms of activities to be set, but also the KM perspective which is taken when a method is performed. In this way, the context can be represented more accurately compared with purely functional specifications.
3. ***Outgoing and delivered information***: Again, we distinguish two different elements, once a method application has been completed: The outcome denoting the effect of using a certain method, and the produced data or output for further processing.

For instance, an application of the Repertory Grid technique [4] is triggered by the need to elicit value systems of concerned stakeholders. For successful application as input a theme and the elements related to this theme need to be provided. The grid encodes a human perspective on KM, as it involves interviewing concerned stakeholders. The output is a documented grid with the effect of having externalized a person's value system in terms of construct/contrast elements for a given set of elements.

For each of the project tasks the students generated (several) chains of methods, depending on their understanding of the addressed KM issues and the project. For instance, in case elicited and documented knowledge should lead to business process specifications and prototypical execution for organizational development, methods for modeling and simulating of processes needed to be specified and aligned using the structure mentioned before, according to the students' project objectives.

The students came up with a variety of patterns. In Fig. 2 one of the most common types of structures to encode methods as well as the most common chaining codification for alignment (right part of the figure) are shown. The students used different sizes of bricks and colors to specify methods and their interfaces. In any case a method was encoded as an assembled piece composed of one or two fundamental building blocks extended with the relevant method attributes (trigger, input, outcome, output) serving as interface. The interface elements were positioned in a way to be connected with elements of other method bricks. The left method creation shows a dog-like form, with the tail (left side) being the incoming and the head part delivering information. Other students created two or more legs to encode the 4 interface elements. For incoming and outgoing information not only different colors were used, but also in many cases different types of bricks, e.g., for the incoming part of the left creation big red and small blue bricks, in order to represent the bipartite structure of incoming and outgoing information.

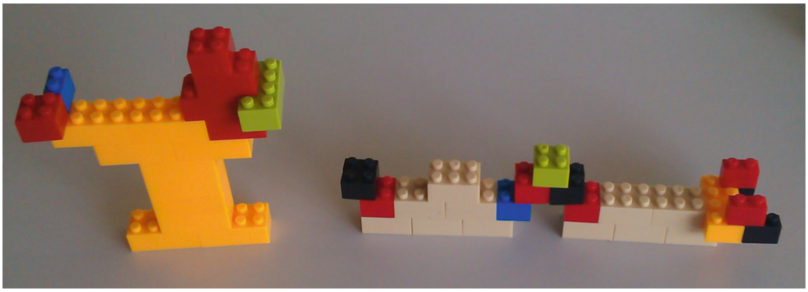

Fig. 2. Sample Lego© brick method structures and a method chain (Color figure online)

The alignment codification of the right creation in Fig. 2 reveals for the outgoing information that in some cases two different method concatenations are possible, as indicated by the two small black input connected to the red output, based on a yellow 'OR'-connector. Some students also marked starting points by shaping the respective method in a unique way (on-top piece in the center of the left method creation in the right part of the figure). Some of them indicated a fit of interfaces, as the right creation shows a fitting connection topped by a green brick. Overall, the students were able to select and utilize bricks not only to encode methods in terms of their structure, but also to link methods through outgoing and incoming information.

3 Walking on 2 Legs

Walking on 2 Legs (W2L) got its name from the objectives of our work as well as the patterns we could identify from the students when codifying the structure and alignment of methods, aiming to meet their project objectives. The name indicates several demands when structuring and aligning methods: (i) Effective method alignment in project management requires an additional source of information, i.e. the context of the problem domain addressed through the project; (ii) It requires two types of constituting interface elements, namely incoming and outgoing information; (iii) Each of them has 2 parts, providing context to input and output, namely the trigger or event initiating the method application, and the effect of applying the method or outcome; (iv) A chain of methods requires at least two method elements to be aligned, in order to complete a project.

In the following we explain the W2L procedure in Subsect. 3.1, before we discuss its digital implementation in Subsect. 3.2 adapting an existing tabletop system supporting tangible structure elaboration.

3.1 Procedure

The proposed procedure distinguishes three groups of project management activities when applying W2L. The first activity contains *required preparation activities (1):*

1.1 Set up a space for method alignment: As a first step, the project manager creates some space for method alignment (e.g., an activity bundle to be discussed when planning) with an appropriate title for the session. Method experts can be invited.

1.2 Provide project or method portfolio: The project manager structures the space with respect to the available method pool and puts in required start information, e.g., method descriptions. It serves as development repository, in order to ensure sharing of documentations and traceability of the planning and design process.

The subsequent set of activities concerns *method refinement/adaptation activities (2)*. The following tasks are mainly performed by the participating project team members and method experts, guided by the project manager. Steps 2.1 through 2.4 are running simultaneously and in an iterative manner. They do not have to follow a strict sequence.

2.1 Trigger a group meeting (if required): The project manager invites project team members to a project design meeting. Depending on the project, he/she may ask to acquire additional information and put it into the portfolio.

2.2 Participants scope work packages and project tasks: The manager invites project team members to start specifying the scope of the method chain to be specified, e.g., work packages or project tasks, according to their perception of the current situation, or an already existing project plan.

2.3 Project manager presents current method pool: As soon as the scope has been specified, project team members can propose methods to be used for achieving the objectives of the task or work package. Other team members can ask questions for clarification and issue concerns. The project manager should guide the presentation through time budgeting, re-phrasing, and structuring information.

2.4 Participants acknowledge method pool and selection: Participants provide their acknowledgement in this step for the selected methods. These methods represent the list of candidates to be aligned. This step is considered a milestone for project planning, as the method baseline has been set for a work package or project task.

The third set of activities leads to *method refinement and alignment (3)*, and is performed by the project team:

3.1 Check elements and relations: Team member contributions may vary in providing insights and information. However, each method can be checked for completion ensuring respective interfaces. The project manager keeps track of the progress. A method chain is constructed based on the selected methods.

3.2 Detail required incoming/outgoing information: Project team members provide the attributes for each category of interface information (trigger, input, output, outcome) for all represented methods. The project manager keeps track of the progress.

3.3 Align according to interfaces: Project team members check whether each output/input-pair fits according the previously specified attributes for all represented methods. In case of conflicts proposals for alignment are collected and discussed. It might be required to go back to the pool of methods or/and invite additional experts. The project manager keeps track of the progress.

A method alignment space is creating through representing methods and their interfaces. The fundamental element denotes the method. Each method has a certain structure, as shown in Fig. 3 in diagrammatic form. It consists of the already mentioned name, and incoming and outgoing information.

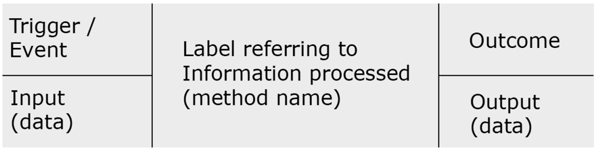

Fig. 3. A diagrammatic representation of a method

3.2 Digital Implementation and Field Test

Interactive digital support can effectively be provided by tangible 3D manipulatives on a tabletop device enabling structure elaboration [10, 11]. Such a platform can be designed to increase digital literacy (cf. [2]) in education and organizational settings, and support domain-specific projects, as already demonstrated in healthcare [15]. For Walking on 2 Legs methods become tangible through their structure. Figure 4 shows a schematic representation of the most condensed and the most elaborated way the system can be used for method structuring and alignment. On one hand, a 3D element can represent a single method, as shown in the upper part of the figure, also indicating the internal parts by mirroring the diagrammatic method representation. Such a use requires information beyond simple naming the manipulative, either to be put into the manipulative through markers, utilizing a container function, or through digital note sticking. The latter allows for each manipulative and displayed relation on the surface to record context information.

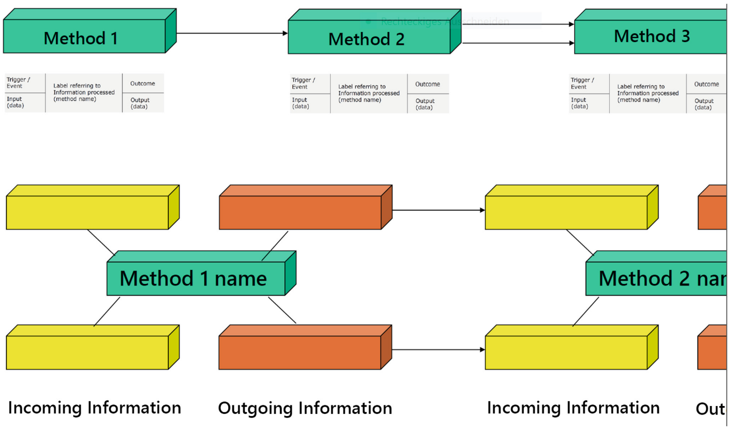

Fig. 4. Structure elaboration support

On the other hand, structuring a method may require up to 5 elements. The latter case encodes the name and each interface in a separate manipulative (see center and lower part of the figure), whereas the single-block representation contains all interface elements under the label of the method. For alignment, the interfaces may be either encoded as relations or manipulatives. As each displayed link on the surface may contain comments, information relevant to alignment may either be stored along a relation or be part of a manipulative. A third variant is using dedicated manipulatives for alignment, either between input and output, or/and between trigger and outcome. When developing method chains, patterns can be analyzed according to the different perspectives as encoded in the relations. Of particular importance are filters when checking correspondence, either between input and output, in order to check their fit, or between trigger and outcome, and for checking the completeness of a method chain.

First field tests of the approach have been performed in the educational setting of Knowledge Management when students needed to plan and design a KM project including method alignment, in order to effectively achieve their project objectives. Thereby, 15 students were asked to report their findings when using W2L. In general, they appreciated the openness to shapes and colors, allowing them to experience methodological design as some kind of game. Although all participants of the field test were able to find a way to structure methods and align them in a coherent way with respect to project objectives, some asked for help on how to evaluate the interface relations, as they were not familiar with handling this type of information. Hence, additional support will have to be provided to that respect.

4 Conclusion

Once projects are also designed from a method perspective, e.g., as required in domain-specific or knowledge-intense settings, methods need to be selected, structured, and aligned to meet project objectives. We followed an exploratory, stakeholder-oriented approach, by which various formats for structuring and aligning methods have been developed by the stakeholders themselves, after having been introduced to minimal structure requirements. The procedure to follow contains a preparation, a specification, and an alignment phase for consolidation. The approach has been digitally supported by a table-top system allowing for context-sensitive specification and arrangement. Future tests and empirical evaluations have to be performed to achieve more practical insights including user support when managing relations, before rethinking the fundamental structure and procedure of the approach.

References

1. Dalkir, K.: Knowledge Management in Theory and Practice. Routledge, New York (2013)
2. Eshet, Y.: Digital literacy: a conceptual framework for survival skills in the digital era. J. Educ. Multimedia Hypermedia **13**(1), 93–106 (2004)
3. Firestone, J.M., McElroy, M.W.: Key Issues in the New Knowledge Management. Routledge, New York (2003)
4. Fransella, F., Bannister, D.: A Manual for Repertory Grid Technique. Academic Press, London (1977)
5. Kerzner, H.: Project Management: A Systems Approach to Planning, Scheduling, and Controlling. Wiley, New York (2013)
6. Kraus, J., Boss, S.: Thinking Through Project-Based Learning. Guiding Deeper Inquiry. Corwin, Thousand Oaks (2013)
7. Larson, E., Gray, C.: Project Management: The Managerial Process. McGraw-Hill, New York (2013)
8. Lakemond, N., Bengtsson, L., Laursen, K., Tell, F.: Match and manage: the use of knowledge matching and project management to integrate knowledge in collaborative inbound open innovation. Ind. Corp. Change **25**(2), 333–352 (2016)
9. Nonaka, I., Takeuchi, H.: The Knowledge-Creating Company. Oxford University Press, New York (1995)
10. Oppl, S., Stary, C.: Tabletop concept mapping. In: Proceedings of 3rd International Conference on Tangible and Embedded Interaction, pp. 275–282. ACM, New York (2009)
11. Oppl, S., Stary, C.: Facilitating shared understanding of work situations using a tangible tabletop interface. Behav. Inf. Technol. **33**(6), 619–635 (2014)
12. Saunders, M.N.K., Lewis, P.: Doing Research in Business and Management: An Essential Guide to Planning Your Project. Pearson, Harlow (2012)
13. Senge, P.M.: The Fifth Discipline: The Art and Practice of the Learning Organization. Broadway Business, New York (2006)
14. Stary, C.: KM curriculum design for reflective practitioner's capacity building. In: Proceedings of 11th International Conference on Knowledge Management, ICKM 2015, pp. 281–290 (2015)
15. Stary, C.: Non-disruptive knowledge and business processing in knowledge life cycles-aligning value network analysis to process management. J. Knowl. Manag. **18**(4), 651–686 (2014)
16. Stary, C., Krenn, F., Lerchner, H., Neubauer, M., Oppl, S., Wachholder, D.: Towards stakeholder-centered design of open systems: learning from organizational learning. In: Proceedings European Conference on Cognitive Ergonomics 2015, p. 26. ACM, New York (2015)