

TEACHING DATA STANDARDS USING LEARNING APPLICATIONS: A GAME-BASED EXAMPLE FROM SUPPLY CHAIN MANAGEMENT

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Abstract:

This paper is highlighting the results of a project that was conducted by the University of Applied Sciences and Arts Northwestern Switzerland and GS1 Switzerland. GS1, a global not-for-profit organization, develops standards related to supply chain management. Teaching programmes are offered to raise awareness of the importance of standards and ensure their correct application. As today's Information Technology enables innovative, interactive learning approaches, an initiative has been started to design a gamified learning application. The design of this application envisages a division into two learning paths. One of the learning paths is aimed at creating the theoretical foundation for understanding the elements and concepts of GS1's standards. The other path will provide the learners with an interactive showcase that includes elements of storytelling. Both components will be integrated in one common dashboard that guides the learning process. The design of the application is elaborated using established requirements engineering techniques, like mockups or activity diagrams. This paper offers insights into the potential of game-based learning applications for supply chain management in the context of professional and higher education.

Keywords: learning application, serious games, professional & higher education, GS1 standards.

1. INTRODUCTION

1.1. The importance of data standards for today's economy

In our modern world, consumers expect a constant and timely availability of desired goods. In order to meet this demand, companies need to join forces and form complex supply chains – more aptly named supply networks (Laudon & Laudon 2016, p. 392). Each partner within such a network contributes with a particular step in the transformation of raw materials into products that are ready to be offered to the final customer. The systematic coordination as well as an efficient flow of goods between trading partners represent a major challenge. How can one ensure that all relevant components like materials, sub-assemblies, packaging and so on can be controlled, documented and tracked throughout the end-to-end business process?

It must be stressed, that transparency along the supply chain is not a “nice-to-have” but, on the contrary, a legal obligation in many countries around the world (e.g. EU Regulation on traceability of explosives). Standardization is the answer to achieve this goal. As the International Standardization Organization (ISO) quotes, documented standards help to „provide requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose“ (ISO, 2017). In particular, data standards enable a unique identification as each product and its components is consistently labelled with an identifier (ID) and characterized with the help of attributes that follow a pre-defined naming convention.

Standards present many advantages to the economy. A few of these are named by the SNV, the Swiss representative of the European Committee for Standardization. Standards secure, facilitate or enable a market entry for new products and services, they can save costs during the development process and as a result, provide competitive advantages (SNV & economiesuisse, 2013).

1.2. Challenge of effective teaching data standards

GS1 is a global not-for-profit organization that develops standards, which are widely spread in supply chain management. Their „standards enable organizations to identify, capture and share information smoothly, creating a common language that underpins systems and processes all over the world“ (GS1, 2018). In general, standards can only be beneficial to adaptors if as many interdependent instances as possible are aware of existing standards and apply them correctly.

In order to raise awareness for their standards, GS1 organizes trainings, workshops and learning events to educate attendees on how to engage with and use the standards. However, because the standards and their descriptions are large in size and complexity, teaching them can be a challenging task. Nevertheless, it is crucial that professionals are aware of standards and are taught to correctly apply them in their respective field of work.

Although established classroom trainings have shown that it is possible to teach standards using classical methods and study materials, organizations notice that there is a need to find more interactive ways to support a transfer of knowledge to practice. In addition, thanks to advances in Information Technology, there exist more modern alternatives to teach data standards with the help of software that makes it possible to experience first-hand an abstract topic like supply chain management and standardization. Recognizing that there is a need to develop the training of standards further, Switzerland's representative of GS1 lead a project to engineer a prototype for a learning software, hoping that such a software could raise awareness for the standards, reduce complexity due to interactivity and provide broadly accessible self-study materials with practical relevance. So they requested a concept and set requirements for a software prototype to be elaborated in a bachelor thesis.

2. ENVIRONMENT OF STUDY

2.1. Background of the Gamification

The term “serious game” refers to a subset of games whose purpose is more than simple entertainment. In addition to the playful aspects of a game, serious games have the power to achieve learning and practicing effects (Hoblitz, 2015, p. 19; Stieglitz, 2017, p. 4).

Such games might be well-suited to reduce complexity of the topics that are traditionally a part of multi-day seminars' curriculums by providing content in interactive case studies (Routledge, 2016, p. 15). Simulating situations that occur in reality may, as a result, lead to an information transfer and the building of theoretical and experimental knowledge (Routledge, 2016, p. 13).

Learning games are usually based on traditional gaming mechanisms, but emphasize the goal of alter certain behavior. In most cases, serious games enliven the learning content by storytelling, rewarding progress and by overcoming challenges (Kapp, 2012, p. 16). By doing so, serious games can serve as an entry point into any new knowledge domain, which is then called familiarization. “As everything is very new at this point, knowledge segments should be short, simple to understand and digest and should contain lots of imagery and diagrams” (Routledge, 2016, p. 118).

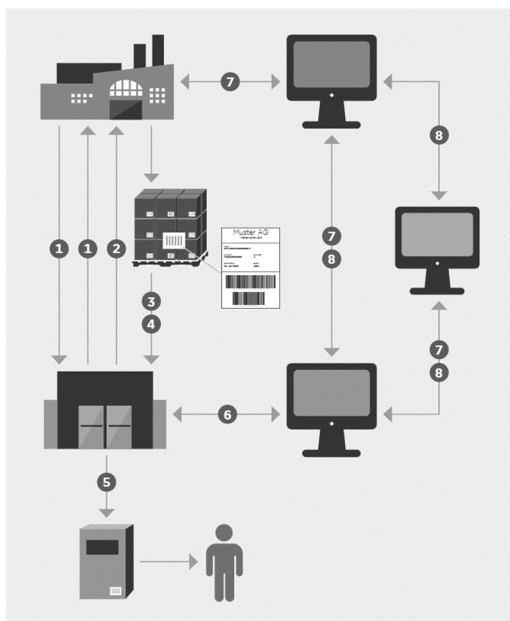
It is questionable which type of game mechanism best serves to effectively transfer learning elements and challenges. Most often, generic, enterprise-wide processes are suitable to be implemented as a game (Hoblitz, 2015, p. 22).

2.2. Background on GS1’s data standard

In order to support enterprises to operationalize their logistic processes, GS1 develops multiple standards which are published under the name “GS1 system”. Beneficial to the success of the system is its neutrality to industries. Therefore, the GS1 system is broadly and nearly boundlessly applicable without affecting already established systems (GS1 Switzerland, 2016a, p. 4).

The system is divided into three broader categories: identify, capture and share. Standards dealing with the “identify” category ensure that traded goods (products), logistic units and locations can be determined systematically by using a set of numbers uniquely. Standards that target the “capturing” part enable the encoding of the numbers as barcodes, and hence permit electronic processing. Lastly, communication-standards (“share”) enable the electronic communication of master- and transactional data (GS1, 2017). Table 1 and Figure 1 show the interaction of the described categories in GS1’s system in a very simplistic way.

Figure 1: Visualized interactions of standards in GS1's system



Source: GS1 Switzerland, 2016b, p. 6

Table 1: Described interaction of standards in GS1's System

N.	Description
1	Providing product range including the respective global trade item number (GTIN) or syncing article master data between business partners.
2	Ordering goods using global trade item number (GTIN).
3	Delivery of goods having units, which are to be shipped, identified by a serial shipping container code (SSCC).
4	Incoming goods. Automatic capturing of barcodes using a barcode scanner. The encoded SSCC and GTIN allow access to master data.
5	Vending of goods to the consumer. Automatic capturing of barcodes using a barcode scanner. The encoded SSCC and GTIN allow access to master data.
6	Reporting of sold goods using GTIN.
7	Triggering an automated purchasing process based on the previous report.
8	Synchronizing master and transactional data.

Source: GS1 Switzerland, 2016b, p. 6

2.3. Background on Target Audience

One primary goal regarding the design of a learning application supporting the training of data standards was to create a software that could be flexibly used and adapted. This led to interviewing representatives of possible prospective user groups during the process of the bachelor thesis in 2017. Lecturers of both, schools of applied sciences and GS1, wish to utilize such an application as part of their future curriculum. Students should benefit from interactive learning experiences over teacher centered lessons. Consultants of GS1 may refer to the application, when explaining the system to a member company (licencee) and, in reverse, employees of member companies may consult the application to follow along company internal self-study programmes (Schwarzenbach, 2017, pp. 41-42).

Also, from the analysis of prospective end users, the software should target entry-level learners, since again, the primary purpose of the application is to raise and spread the awareness of the standards. This leads to the assumption that there are almost exclusively adult learners in the audience. Precisely those who are not yet familiar with the standards and who do not have any prior knowledge (Schwarzenbach, 2017, p. 43).

Eventually, a combination of the results of the foregoing analysis and the desire to reuse previous learning materials, concludes in a two-part web-based application where one part offers material to study theoretical foundations and the other focuses on a practical showcasing of the standards. The following insights are taken from the bachelor thesis written by Schwarzenbach.

3. DESIGN OF FUTURE LEARNING APPLICATION

3.1. The learning path – Building the theoretical base

In a first part, which should represent an independent component of the application, some input to build a theoretical foundation is offered to the user. This approach is supportive to the idea of using existing study material continuously and sustainably. Existing material such as PowerPoint-slides or brochure content shall be available to view or download (Schwarzenbach, 2017). The idea behind this module of the application is to provide an option to read about specific topics, solidify what has already been learned and/or close knowledge-gaps. A quizz at the end of each section could add some gamification characteristics.

Regarding the future example application, it is intended that the content is provided in a modular structure, each covering one narrow, specific topic. This decision refers in turn to the serious games theory stating that learning segments are preferably presented in condensed units (Routledge, 2016, p. 118). Learning modules are created using a built-in content-management-system that administrators can access. As a matter of course, existing slides could also be uploaded and assigned to a module. In order to support learners in their self-study process, explanatory text may be added to the slides. Another benefit of having a content-management-system and a modular construction is the fact, that the application can be easily extended.

3.2. The learning path – Practice the process in a showcase

A second part of the future learning application focuses on experiencing the standards interactively. In other words, a user assumes the role of an employee in any industry. The showcasing part is designed to display the “standards in action”. The application of the standards in practice is to be simulated in a mindful but playful manner. In multiple interviews, it was decided to elaborate a learning path displaying the role of four participants – a manufacturer, a carrier, a wholesaler and a retailer – in a supply chain.

Defining the learning path

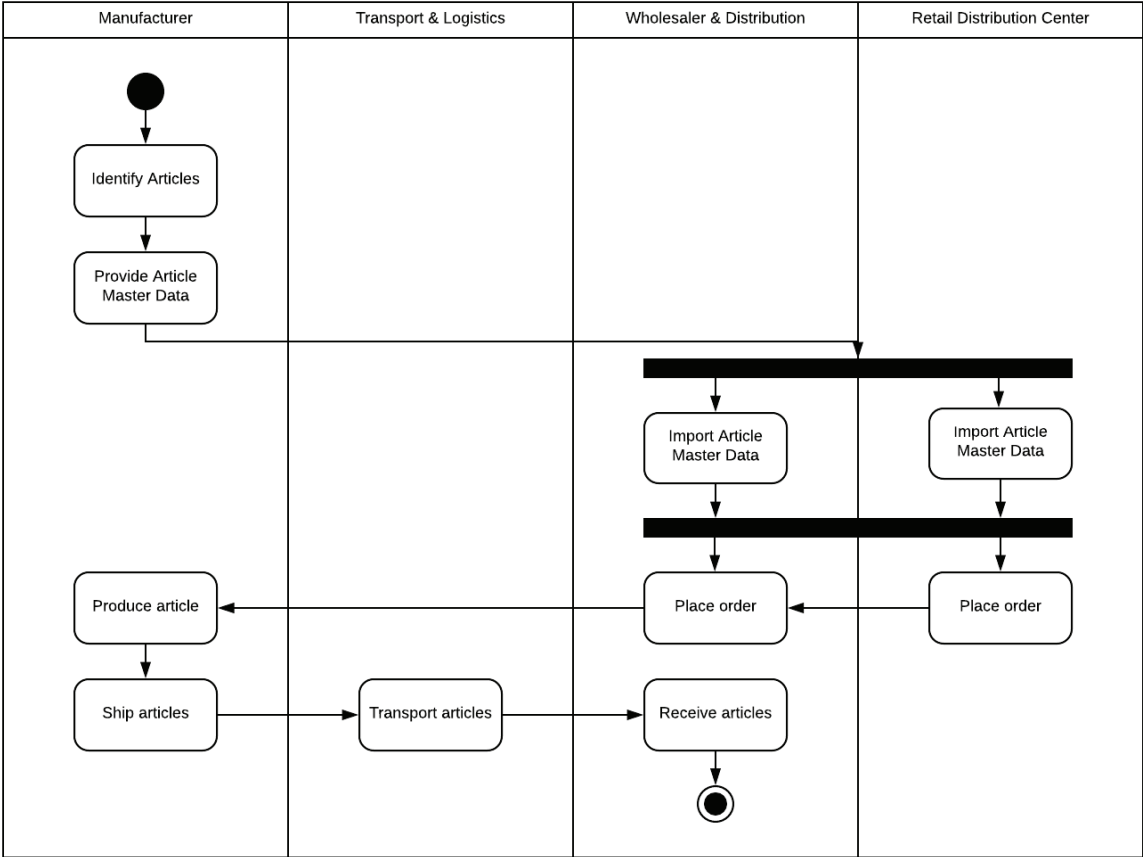
In the future gamified learning application, the users mimic the role of a manufacturer of goods who has the task to implement the GTIN for the articles as a prerequisite to deliver them to a major retailer. During the process, a learner can follow the flow of the product throughout the supply chain, starting with recording product data in a fictive system, ordering goods in the role of the retailer, and shipping the goods via a logistics provider, while reproducing every step performed by the members of a supply chain. The process steps are described in Table 2 and visualized in Figure 2 using Unified Modeling Language (UML).

Table 2: Description of activities shown in Figure 2

Steps (row by row)
1. Identify articles with GTIN
2. Communicate article numbers (GTIN)
3. Import article master data/Import article master data
4. Produce article/order product
5. Ship ordered products/transport products/receive products

Source: Schwarzenbach, 2017, p. 51

Figure 2: UML Activity Diagram visualizing the showcase process



Source: Schwarzenbach, 2017, p. 51

The activities listed in Table 2 were then transformed into corresponding use cases. Each case describes precisely the mandatory steps a user of GS1's system has to perform in order to ensure the interoperability of the product or service and the conformity to the standard. At this point, an advantage of serious games becomes apparent. The circumstance of entering and managing data (process step 1) is put into action and as a result can be experienced in form of a simplified role-play. An interactive learning application allows the representation of detail at a high level, which reduces abstraction. Reinforcing this concept the process steps 2 and 3 reveal how data is exchanged between trading partners. This learning experience not only reduces complexity but also conveys the importance and significance of correct master data. Additionally, animations, if implemented, can visualize the information flow.

Personifying the process

As mentioned above, stories assist students to process learning matter and help to reduce abstraction. As a conclusion, it was decided to substantiate the participants' roles by creating fictive characters, which may be supportive to emphasize each participant's tasks as well as their requirements from other participants.

Real sample data

Finally, GS1 supplies a range of real sample data to avoid practicing with rather useless dummy data. In addition, it was decided to provide some data of an existing, common product that results in a tangible playthrough. This supports the personification of the roles that are to be played, because the "profession" of the manufacturer is already given.

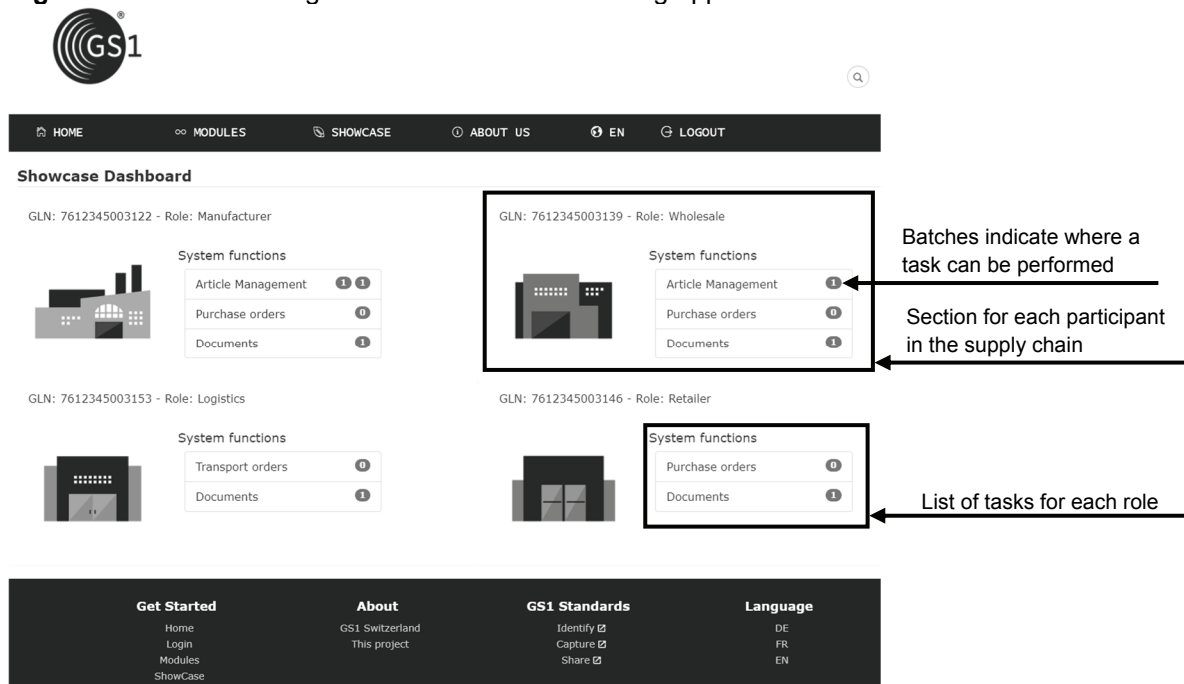
3.3. Combining theoretical and practical learning paths via a dashboard

It has been considered, how the theoretical and the practical learning paths within the future learning application could be combined. Eventually, the idea of a dashboard came up, which should function as an entry point to the practical showcase. It might be promising to elaborate this idea further. Figure 3 shows a refined mockup of how such a dashboard might look.

The dashboard should be divided into sections, each representing a business unit of the supply network. In the illustration, four sections are presented corresponding to the four roles described in the bachelor thesis of Schwarzenbach.

Each section displays links that lead to the tasks intended for each role (see Figure 2 for reference). Batches with numbers next to the tasks indicate where a process step must be performed. When a user enters a task, a reference to the respective learning module of the theoretical learning path is provided.

Figure 3: Refined drawing of a dashboard for a learning application



Source: adapted based on Schwarzenbach, 2017

4. CONCLUSION AND SUMMARY

Educators of data standards using a serious game as an educational platform have a valuable tool to simulate complex circumstances by reproducing a real situation. Real and tangible sample data help to reduce potential psychological barriers and allow users to try as many variations as possible without having to be afraid of making errors. Animations help to visualize automated, pre-defined sequences in a process that usually does not need any user interaction.

Breaking down the content into smaller nuggets and presenting these activities as a task of a supply chain's participant, in other words underlining the learning path with a story, helps to retain what has been learned.

An application, furthermore, is not bound to the learning speed of a lecturer or to planned lecturing units. Therefore, a learner can customize the speed to his or her skills.

Serious games, in summary, have a major potential to at least complement traditional learning approaches and present a possibility to substantially improve the efficiency and effectiveness of employees, thanks to playful elements during the work and the learning process. Therefore it is highly recommended to implement elements of serious games to effectively teach standards.

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