

Analysis of best practices for interactive content design and development for digital communication¹

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Abstract

Introduction. Several authors practice and disseminate good practices related to interactivity and agile, and from different areas and disciplines, as part of their activities, but few integrate them to develop projects. **Objective.** This paper presents the results of a review in which the level of dissemination of good practices related to these areas and those proposed for structuring, designing, and evaluating interactive content are investigated. **Method.** To conduct reliable literature reviews, it is necessary to build an initial protocol in which the research methodology is structured. **Results.** The final

sample is made up of 100 works distributed mainly among articles, presentations at events, and online contributions. It was found that 47 % of the researchers publish about good practices to indicate an area or discipline of application, while 21 % describe them from interactivity and 24 % from agile. **Conclusions.** Furthermore, the good practices found are the result of personal experiences, not general validations, which makes it impossible to conclude whether they are really good.

Keywords: Interactive Content; Project Management; Interactivity; Best Practices; Agile Methods.

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Análisis a las buenas prácticas para el diseño y desarrollo de contenidos interactivos para la comunicación digital

Resumen

Introducción. Diversos autores practican y difunden buenas prácticas desde diversas áreas y disciplinas relacionadas con la interactividad y el agilismo, pero pocos las integran para desarrollar proyectos. **Método.** Para realizar revisiones de la literatura fiables es necesario construir un protocolo inicial en el que se estructure la metodología de investigación. **Objetivo.** En este trabajo se presentan los resultados de una revisión en la que se indaga por el

nivel de divulgación de las buenas prácticas relacionadas con estas áreas y de las que se proponen para estructurar, diseñar y evaluar contenidos interactivos. **Resultados.** La muestra final la conforman 100 trabajos distribuidos principalmente entre artículos, presentaciones en eventos y aportes en línea. Se encontró que el 47 % de los investigadores publican acerca de las buenas prácticas para indicar un área o disciplina de aplicación, mientras que el 21 % las describe desde la interactividad y el 24 % desde el agilismo. **Conclusión.** Además, las buenas prácticas encontradas son el resultado de experiencias personales, no de validaciones generales, lo que impide concluir si realmente son buenas.

Palabras clave: contenidos interactivos; gestión de proyectos; interactividad; buenas prácticas; **métodos ágiles.**

Análise das melhores práticas para a concepção e desenvolvimento de conteúdos interactivos para a comunicação digital

Resumo

Introdução. Vários autores praticam e divulgam boas práticas de diferentes áreas e disciplinas relacionadas com a interactividade e agilidade, mas poucos as integram para desenvolver projectos. **Método.** A fim de realizar revisões de literatura fiáveis é necessário construir um protocolo inicial no qual a metodologia de investigação seja estruturada. **Objectivo.** Este documento apresenta os resultados de uma revisão em

que se investiga o nível de disseminação de boas práticas relacionadas com estas áreas e as propostas para a estruturação, concepção e avaliação de conteúdos interactivos. **Resultados.** A amostra final é composta por 100 trabalhos distribuídos principalmente entre artigos, apresentações em eventos e contribuições em linha. Verificou-se que 47 % dos investigadores publicam sobre boas práticas para indicar uma área ou disciplina de aplicação, enquanto 21 % as descrevem a partir da interactividade e 24 % a partir do agilismo. **Conclusão.** Além disso, as boas práticas encontradas são o resultado de experiências pessoais, não de validações gerais, o que torna impossível concluir se elas são realmente boas.

Palavras-chave: conteúdo interactivo; gestão de projectos; interactividade; boas práticas; **métodos ágeis.**

Introduction

Interactive contents are artifacts that in response to a user's action or request present options (paths) depending on where in the element the action is initiated. Consequently, by following different options, the user can control or change the action of the artifact (Murtagh *et al.*, 2011). They integrate digital media including combinations of electronic text, graphics, moving images, and sound into a structured computerized digital environment, allowing users to interact with data to achieve specific goals. This digital environment includes the Internet, telecommunications, and interactive digital television.

This interactive world is constantly changing and the number of different devices that are connected is growing every year. The problem that arises in this accelerated development is that there are no clear rules for integration, and because new products are continuously being created with different systems and technologies, it is inevitable that users will have to find creative ways to adapt each time (Fill, 2009). The use of interactive content extends from education to marketing, and from computational modeling and simulation to virtual reality. This is why, to create a responsive, efficient, and effective design, the process must be properly planned. In addition, designing interactive content is different from what is normally done for traditional non-interactive content, especially because it cannot be based on a fixed size and because it is not simple to delineate each component.

The increase in the use of this type of content, the development of technologies to design them, and the multiple utilities that are discovered every day, make that the techniques and methodologies to develop them have to be continuously updated. If the objective is to achieve the goals and objectives of each product effectively and efficiently and to prevent it from

becoming one of the many that are launched to the market, the structuring, design, and evaluation processes must be updated.

Because of this, the possibility of increasing its effectiveness and efficiency by including the best practices of agility and interactivity in its processes is an alternative that should be taken into account. In this sense, from the perspective of interactive design, the goal of agile is to try to reach a reliable prototype as soon as possible. Agile methods strive to quickly deliver small feature sets to customers in short iterations, i.e., the designer works without taking into account other activities that could delay partial delivery (Ratcliffe and McNeill, 2012). In this process, teams should interact based on a rapid assessment of similar points in terms of approach and possible tensions that may arise along the way (Ferreira *et al.*, 2011).

From the perspective of interactivity, it is first necessary to define the relationships between the term's *interaction*, *interactive*, and *interactivity*. An interaction implies at least two participants and in the context of human-computer interaction, the human being interacts with the computer, which is interactive because it allows interaction. The term interactivity denotes the interactive aspects of the artifact, so the relationship between interactivity and interactive is the same as between radioactivity and radioactive: uranium is radioactive, and Madame Curie studied radioactivity. While computers are interactive, the word interactivity can be used as a noun to mean a general phenomenon, or a property, as in *computer interactivity*.

One way to approach interactivity is to start with the notion of *seeing and feeling*. The expression has become more or less synonymous with how the term *style* is used in other design disciplines. In a concrete sense *seeing* means observing, for example, the appearance of a Graphical User Interface (GUI); while *feeling* denotes its interactive aspects,

so designing a GUI is not much different from designing other visual media. But the fact that the screen is made up of a limited number of pixels provides some interesting challenges. Throughout the visual dimension, one can draw on rich traditions in art, graphic design, advertising, film, and television. This has for centuries caused people to have problems with visual media, because the current technical, aesthetic, artistic, and psychological knowledge is the culmination of the life's work of thousands of people over the past centuries. Compared to this, the *feeling* dimension has hardly been investigated.

Agile is an iterative and incremental method for the management, design, and construction of activities in fields such as engineering, information technology, and new projects for the development of flexible and interactive products or services. The most important aspect of agile is that the deliverables of each project are presented in stages, i.e., small portions in each cycle (iteration). This principle was developed as a reaction to the various obstacles encountered in the traditional way of developing projects sequentially.

This approach can be effectively leveraged in the development of all types of projects, where the result will be a product that is better adapted to the needs and delivered at minimal cost, with little waste, and on time, allowing companies to achieve results closer to what the customer needs. On the other hand, the principles of agility are also process-oriented, and its purpose is to simultaneously save costs, mitigate risks, accelerate time to market, and improve worker productivity while promoting collaborative work to improve overall profitability.

They are methodological principles based on iterative work, where needs and solutions evolve through collaboration among self-organized cross-functional teams. Generally, they promote a disciplined project management

process that encourages frequent inspection and adaptation, a leadership philosophy that promotes teamwork, self-organization, and accountability through a set of best practices aimed at achieving rapid delivery of products, but with high quality, and as a business approach aligned with the development of customer needs and the achievement of business objectives.

To merge the best of both concepts, agility, and interactivity, seen as a set of best practices, the research project of which this review is a part is carried out. The idea is to find answers to the following research questions: what are the best practices published in the literature about interactivity and agile? In which areas or disciplines do the authors apply interactivity or agile? What are the best practices proposed in the literature for structuring, designing, and evaluating interactive content? Furthermore, it is assumed that *the good practices disseminated are sufficient to design efficient and effective interactive content*. It is convenient to clarify that the objective of this review is to map the situation without making comparisons or dissertations on the subject because that would be objective if the results were to justify a proposal for improvement or change.

Frame of reference

In the structuring and design of content, different teams converge and must work based on an analytical assessment of the importance of the points of focus on the product, which may be similar or different and generate possible tensions (Ferreira *et al.*, 2011), but in the literature, there is little guidance on how to integrate these two perspectives. Some authors have conducted different research to discover how agile and interactive best practices complement each other in the design of interactive content. Although traditionally these two methodologies use different approaches regarding resource

allocation, timing, attention to requirements, and prototyping in a project (Fox *et al.*, 2008).

Agile strives to deliver small feature sets to customers as quickly as possible and in short iterations; while interactive invests considerable effort in research and analysis before development begins. According to Ferreira *et al.* (2010), there is a growing literature addressing the combination of best practices from agile and interactivity in interactive content design, as can be seen in Silva *et al.* (2011), however, this integration is not adequately addressed (Hussain, Slany *et al.*, 2009).

Hussain, Milchrahm *et al.* (2009) use different Human-Computer Interaction (HCI) tools and conduct a retrospective workshop with all team members to reflect on the integration of the process. They present lessons learned from this integration but focus only on the use of the tools. Chamberlain *et al.* (2006) present a framework that can be used to integrate the practices of interactive design and agile development and suggest principles for successful integration.

Ferreira *et al.* (2007) present a qualitative study of real agile projects involving interactive design and found that the nature of iterative development facilitates usability testing, which allows developers to incorporate the results in subsequent iterations; in addition, it can improve communication and the relationship between work teams. In this sense, and according to Ferreira *et al.* (2011), the problem of achieving the integration of agile and interactive best practices is that teams have to contribute their skills to the development of the project, which has usually been characterized as a fusion between an agile method and a UX design method, which is not easy to achieve.

Sy (2007) describes adjustments in the timing and granularity of usability research and how findings are reported in an agile

environment. He found that the practices of user-centered agile design methods produce better-designed products than applying waterfall versions of the same techniques. Carroll and Beyer (2010) suggest that integrating best practices from both models requires that interactivity designers better understand the principles of agile and present some practices for integrating these two domains. Based on informed ethnographic studies, Ferreira *et al.* (2012) identify essential themes for achieving the integration of best practices from both fields in design.

Method

According to Serna (2018), to conduct reliable literature reviews it is necessary to build an initial protocol in which the research methodology is structured:

1. **Define the thematic area:** best practices from the point of view of interactivity and agility.

2. **Define research questions.**

Q1. What are the best practices published in the literature about interactivity and agility?

Q2. In which areas or disciplines do the authors apply interactivity or agile?

Q3. What are the best practices proposed in the literature for structuring, designing, and evaluating interactive content?

3. **Define the search process.**

- Search terms: buenas prácticas, good practices, mejores prácticas, best practices, interactividad,

interactivity, prácticas ágiles, agile practices, contenidos interactivos, interactive content, agilismo, agile, diseño interactivo, interactive design, implementación interactiva, interactive implementation.

- Databases: IEEEExplore, ACM Digital library, ScienceDirect, Elsevier, SpringerLink, Scopus, Web of Science, DOAJ, CiteSeerX.

4. Define inclusion and exclusion criteria.

- Papers that relate research results in the area of interest.
- Studies in which the results have been verified.
- Research whose focus is visible.
- Studies whose research method is experimental.

To be included in the analysis, a paper had to be peer-reviewed, available online, written in English or Spanish, and report on best practices in agile or interactivity. Papers were classified following a four-step approach: 1) by reading the title and abstract, 2) all papers that did not match the inclusion criteria were excluded, 3) the others were further analyzed and involved quality assessment, and 4) they were classified according to two general categories: (a) *descriptive*: theoretical, experiential, empirical or experimental research, and 2) *content*: focused on (interactivity, agile, or both), approach (specialist, generalist, or specialist/generalist), and results (description of an approach, proposal of an approach, or experience).

5. Define quality assessment. A search was made for articles, books, technical reports, experiences, and empirical, theoretical, and experimental works that had undergone peer review. This was followed by a complete reading of the text, and, in case of discrepancy, a second researcher did the verification. Other criteria for validating quality were:

- Source quality (impact factor)
- Verifiable results
- Level of Acceptance
- Author's background
- Verification of the application
- Relevance of the work according to citations

6. Define data collection.

- Type of publication
- Editorial
- Country
- Date
- Thematic classification
- Research approach
- Research method

7. Define data analysis.

- Relate the good practices found for each thematic area.

- Based on the results, answer each of the research questions.
- Perform statistical matrix.
- Report for the research project.
- Analyze and integrate the results with the reviews.

Results

The papers selected were classified into five areas according to their contribution to the research and the answers to the questions:

Best practices from interactivity

Chamberlain *et al.* (2006), Najafi and Toyoshiba (2008), Ungar (2008), Sy and Miller (2008), and Williams and Ferguson (2007) suggest that interactivity designers should work one step ahead of the development team, Illmensee and Muff (2009) add that they should work two or even three iterations ahead of the rest of the team, and Cho (2009) argues that, when designing interactivity, the user experience should be aligned with the analysis.

One of the problems with interactivity is that its affective benefits, social presence, and satisfaction in mediated situations are not yet perceived, an issue that could be weighed with practices and mechanisms to value it in learning (Yacci, 2000; Svanæs, 2009) argues that to achieve the objectives of a good interaction it is necessary to respect certain principles and apply practices different from those necessary in a human-human relationship. Boyle and Cook (2001) reflect on the application and evaluation of interactivity and propose some practices that seem to significantly influence the effectiveness of collaborative learning; for Chen and Yen (2004) interactivity is becoming a valuable way to improve the quality of

communication in business, so designers need to understand the concept and how it affects the quality of their designs; and Ha and James (1998) propose including practices such as joy, seeking connection, obtaining reciprocal communication, gathering information, and always offering free choice.

Bucy (2004) argues that the perception of interactivity manifests itself as a subjective experience and, although not observable, can be reliably measured as can attitudes, perceived behavioral influence, and other perceptual constructs. Thomas and Roda (2005) provide an overview of some of the different practices that coexist with interactivity; present the identified features and their limitations in interaction; discuss important practices of digital interactivity; select links between authors and the construction of interactive spaces as examples of tools to increase interactivity; and identify some future design applications. Yee (2006) compiles more than 100 practices for achieving effective interactivity that offer benefits to the instructor because he can easily and quickly assess whether students have truly mastered the material and measure comprehension of the material. The issue is that not all of the practices he lists have universal appeal because factors such as teaching style and personality influence cannot be adapted for all situations in which interactivity is implemented.

As people spend more time interacting in front of a screen than in any other activity, fundamental views about the physical world are changing (Ericsson ConsumerLab, 2005). In this report, some interactivity practices are collected to explore people's thinking about the world as a wide internet. Saffer (2006) proposes design practices for creating successful interactive products: 1) user-centered and focused on user needs and goals, 2) focused on the activities that need to be satisfied, 3) focused on system components, and 5) natural. Deighton and Kornfeld (2007)

propose practices for social interactive design: 1) feasible tracking, 2) ubiquitous connectivity, 3) exchange, 4) social reciprocity, and 5) cultural exchange. To describe and manipulate interactivity, it is necessary to apply several important practices and relationships in design: concurrency, continuity, expectations, range of motion, speed of motion, proximity, and speed of response (Lim *et al.*, 2009).

For Noble (2009), in interactivity, almost everything means more or less the same thing, so designing an interactive system is to allow people to interact in a meaningful way. Therefore, the designer must try to understand what the user wants to do and how the system should respond. For Usability.gov (2012), the interactive design focuses on the creation of attractive interfaces with well-thought-out behaviors, where it is essential to understand how users and technology communicate with each other. In this regard, he proposes the following best practices: 1) define how users will interact with the interface, 2) provide users with behavioral guidelines before initiating the interaction, 3) anticipate and mitigate errors, 4) consider the evaluation system and response time, 5) think strategically about each element, and 6) simplify the complicated. For his part, Lamoreaux (2014) proposes three best practices for interactivity: 1) do not move away from real reality, 2) design for sharing, and 3) have a positive attitude.

Best practices from agile

Ambler (2006) suggests modeling the user interface (UI) in advance using tools that reflect agile practices, such as index cards, whiteboard sketches, and low-fidelity paper prototypes. Hodgetts (2005), Fox *et al.* (2008), Najafi and Toyoshiba (2008), and Hudson (2003), suggest applying user-centered design as an agile practice that has proven its benefits in software development. Jokela and Abrahamsson (2004) comment that the practice of task analysis contributes to the development

of user stories, and Meszaros and Aston (2006) and Holzinger *et al.* (2005) suggest that these stories should originate from usability testing of paper prototypes, which can be refined from the stories themselves. Broschinsky and Baker (2008) report the integration of prototypes with user stories; DÜchting *et al.* (2007) propose stories as the best places to elicit usability requirements; Singh (2008) contributes that they should contain usability issues as acceptance criteria; and Beyer *et al.* (2004) suggest that mockups can be part of the definition of stories and as acceptance criteria.

Regarding the management of projects that follow an agile methodology, Detweiler (2007) presents some practices to anticipate and address the potential problems that agile entails. Sy and Miller (2008) describe some agile practices as part of their experience, among which the leader must possess powerful persuasion skills. Obendorf and Finck (2008) state that improving the quality of products to meet user needs should be the goal of any agile initiative, but in practice, project members from different disciplines collaborate little and processes often rely on a sequential division of labor, which limits the effectiveness of applying agile principles from different perspectives.

Strode (2005) found four common practices that teams working with agile apply: 1) adapt the methodology and accommodate the unique attributes of the project in which it is used; 2) open to the challenges and changes that the technique proposes; 3) omit irrelevant aspects; and 4) specify at the lowest level they can. Arthur (2014) presents a list of best practices for the team: having the right people for the project, having clear roles, being flexible to change, prioritizing delayed activities, having stories and scenarios, and continually re-evaluating priorities. Ambler (2014) describes several agile practices and opines that many may find difficult to understand, due to their granularity and vagueness: active stakeholder involvement, documenting continuously,

presenting executable specifications, performing iterative modeling, designing multiple models, prioritizing requirements, and testing continuously. Јовић (2012) found several difficulties in realizing his project in an agile way and proposes some practices as a solution: maintain continuous integration, reuse as much as possible, design small cycles for process development, and use design patterns.

From software development, Makabee (2013) describes a series of agile practices to achieve better products, among the most outstanding are continuous planning, simulating delivery times, constant feedback and modeling, and writing user stories. The American Council for Technology-Industry Advisory ([ACT-IAC], 2014) presents a report of recommended practices for the IT services industry: focus on risks, identify stakeholders early, adopt appropriate measures to control costs and process performance, and identify, control, and quantify internal management costs. To successfully achieve scalable, reliable, flexible, extensible, and maintainable products, Indukuri (2014) proposes a series of agile practices: incremental design and planning, short development cycles, continuous and automated early testing, and analyzing the causes of errors and achievements. VanderLeest and Buter (2009) discuss some agile practices that they consider fundamental to apply in the aerospace domain: structure the team around motivated people with the necessary context, support, and confidence to get the job done; continuously measure project progress; maintain a sustainable pace; pursue technical excellence and good design; build metaphors; and respect domain-specific standards.

Areas or disciplines of application of interactivity

Fuhrmann *et al.* (2001) demonstrate how usual content (text or images) can be integrated

into 3D models to structure a presentation, combining the advantages of traditional methods with interaction techniques and virtual reality devices. Walczak (2008) presents a new approach for the structured design of complex interactive virtual reality applications, based on two elements: 1) the composition of virtual reality content, and 2) a high-level virtual reality content model. Ekman and Lankoski (2004) provide interactive content for television, related to program design for the age of interactivity. Aston and Gaudenzi's (2012) discussion centers around the act of developing and making interactive documentaries (i-docs), and they provide a conceptual view of what they are, where they come from, and what they might become.

Thomas (2001) presents a look at the nature and desirability of e-Learning content and examines key issues for its effective production and Zhang (2005) evaluates the effectiveness of interactive e-learning. Domagk *et al.* (2010) reflect on interactivity as a widely used term, to which they attach great prominence in multimedia learning discussions. They aim to aid research, discussion, and design decisions in interactive multimedia teaching.

For Homer and Plass (2014), there has been considerable interest in the educational effectiveness of open-ended discovery pedagogical approaches, as compared to more direct approaches to learning and teaching. Some criticize guided teaching methods because they increase cognitive load and thus reduce learning; while others defend them because many teaching methods that have a constructivist orientation, such as PBL, are not guided at all and are effective. Still, others present several reasons for disagreeing with both and include differing views on the nature of learning and the significance of interactivity as a tool for achievement.

Dalgarno *et al.* (2009) report computer-based educational models of interactivity

that emphasize the important role of learner cognition. It has been suggested that interactive learning tasks, performed in the context of an authentic PBL scenario, result in deeper and more elaborate cognitive processing to strengthen conceptual understanding of the presented material. They designed a model to enhance such student cognition, and initial results, in which they compared brain activation when exploring an interactive simulation and when using an equivalent single-participant tutoring program, provide insight into the feasibility of the proposed methodological approach.

Coviello *et al.* (2001) state that of particular interest in the literature is the notion of interactivity within and between companies and customers, as a new phenomenon in marketing practice and research regarding the rapid and widespread diffusion of IT. Their work aims to understand the impacts of interactivity on contemporary marketing, for which they synthesize existing and emerging literature, and develop two related conceptual frameworks useful for discussion and empirical research. In his book, Fill (2009) argues that the interactional approach has increased the influence and use of interactivity in business development-oriented communications. The emergence of digital media has helped to change the primary mode of communication from one based on one-way mass communication to one that is essentially individual and transformational allowing interaction. It further suggests that understanding the interaction and its main characteristics requires an understanding of the dynamics and dimensions of interactivity, which should be possible to develop more effective marketing communications. In this context, interactivity can be considered from two perspectives: 1) the technology, tools, and features provided for interaction, and 2) the added value perceived from interactivity to achieve the communication process. On the other hand, with the advent of digital technologies, marketing researchers

and practitioners continuously seek an understanding of how information is produced and consumed (Kirk *et al.*, 2012). This study explores the relationship between interactivity, consumer satisfaction, and intention to adopt information products in a digital framework. The results suggest that in a utilitarian context, consumers are more likely to adopt interactive books than traditional static e-books. However, satisfaction with interactivity is moderated by consumer age: older consumers prefer static books, while younger consumers prefer interactive e-books.

Varma (2009) examines how students learn scientific concepts related to the greenhouse effect by engaging in scientific reasoning activities with an interactive model. A long-standing problem in didactic research is the tension between teaching science content vs. scientific process or reasoning, but, according to the author, after instruction and experience, students can participate and describe it in familiar or simple contexts. However, concerns persist about overloading their cognitive resources when they are forced to engage in activities that involve the use of reasoning strategies to learn new scientific content. Vork (2013) presents an interactivity-based approach to human problem-solving in nature and introduces this notion defined as a coordination of senses that contribute to human action. According to the author, interactivity is an ontological substrate that can be studied as interaction, cognition, or ecological production. While she argues theoretically in favor of a unified, transdisciplinary approach to interactivity, she directs her attention to the cognitive ecology of human problem-solving.

Areas or disciplines of application of agile

According to Winter (2009), to some, agility in business sounds like something that is done to fend off tax collectors and accountants during a crisis; to others, the concept is another buzzphrase; whereas to him, agility

in business is the ability to think on one's feet and use skills to improve them, getting the most out of people for the longest possible time. His work aims to explore in-depth the complex relationships of agility in business through a combination of research-reflection on professional practice, and he confidently asserts that it is the cornerstone of the bridge between flexibility and change in business. Agile has become one of the predominant forms of software development, but Arell *et al.* (2012) question how to make the mindset and benefits associated with it permeate the entire organization. In their paper, they present an analysis of several successful companies that have adopted this management style. Although many different practices and paradigms are used, depending on the size, domain, and culture of the company, they find a small but powerful set of underlying characteristics common to all of them.

For McKenna and Whitty (2013) agile is generally conceived as a means of moving from traditional technical processes to a more proactive and inclusive approach and is perceived as the inevitable outcome of the evolution of project management methodologies. His work explores the role and practice of agile in project management and how it has come to incorporate methods and tools that can be found in all activities, on which the rapid economic growth of the 20th century was based. On the other hand, according to Rehani (2011), the rapid evolution of the economy has influenced Business Intelligence (BI) systems to seek innovative ways to be equally fast and flexible. And it has created a need to be more intuitive and faster in execution to adapt to the changing environment. One of the ways organizations can achieve these goals is through the use of agile-based BI development models. The recession and economic instability in recent years have forced organizations to rethink the development and delivery of BI solutions, so they need to fall on faster, lower-cost

deployment models. Therefore, one must think beyond traditional approaches and look for solutions that can offer greater capabilities and provide more agile deployments. This can certainly be achieved by using Agile for BI implementations.

Paiva *et al.* (2013) describe an experience of integrating agile practices in undergraduate and graduate courses. Through a case study, they used a PBL strategy together with agile best practices within a development project. During the experiment, students had to interact and collaborate to produce a prototype of a smart grid system, in the simulation of a real development project. In turn, and like other authors, the conclusion of Paasivaara and Lassenius (2014) is that agile has become the mainstream for contemporary software development. This method was created to support the work of small teams of developers with extensive experience working in a single room. As a result, they rely heavily on face-to-face communication, which limits the maximum practice size of the team. However, agile is increasingly adopted in large organizations running large software development projects and employing multiple teams distributed across multiple geographic locations. For Waters (2007) agile development is a different way of managing teams in software development projects and to demonstrate this he takes and values four important values of the agile manifesto: 1) individuals and interactions over processes and tools, 2) working software over extensive documentation, 3) collaborating with the customer according to contract negotiation, and 4) responding to changes by following a plan. As a result, he describes 10 key principles of agile software development:

1. Active participation of users.
2. The team must be empowered to make decisions.

3. The requirements evolve, but the time scale is fixed.
4. Requirements are captured at a high level.
5. Develop small, iterative, incremental releases.
6. Focus on frequent product delivery.
7. Complete each feature before moving on to the next one.
8. Apply the 80/20 rule.
9. Testing is integrated into the entire project life cycle.
10. A collaborative and cooperative approach among all stakeholders is essential.

Best practices for structuring, designing, and evaluating interactive content

Papers were found that propose good practices for structuring, designing, and evaluating interactive content, the central theme of the research in which this review is framed. Although not all of them explicitly describe these practices, nor do they propose them directly for interactive content, it is possible to deduce their intention from the reading. The most significant ones are detailed below.

Sohaib and Khan (2010), Coatta and Gosper (2010), Fox *et al.* (2008), Meszaros and Aston (2006), Holzinger *et al.* (2005), Detweiler (2007), Miller (2005), Ungar (2008) and Chamberlain *et al.* (2006) suggest that content prototyping activities should occur at an early stage. They also comment on the benefits of using prototypes to improve communication between interactivity designers and developers and to

perform usability evaluations. For their part, Hussain, Milchrahm *et al.* (2008) say that prototypes can be derived from user stories; Ungar (2008) and Benigni *et al.* (2010) also suggest that interactivity designers should design interface prototypes one interaction ahead of developers, and Federoff *et al.* (2008) recommend that these designers should work in parallel with the development team. However, Sy (2007) suggests that they work one iteration ahead concerning prototyping, but one iteration behind concerning testing.

Hudson (2003), Hussain, Milchrahm *et al.* (2009), Meszaros and Aston (2006), Fox *et al.* (2008), Lee and McCrickard (2007), Obendorf and Finck (2008), Hussain, Milchrahm *et al.* (2008), and Holzinger *et al.* (2005) suggest that to achieve better content structuring it is convenient to run paper-based user tests for prototypes; Miller (2005) proposes to run these tests on both early and advanced prototypes, and Illmensee and Muff (2009) suggest to perform them informally and not in usability labs. For their part, Beyer *et al.* (2004) point out that the user interface can be tested with users through mockups and interviews, taking advantage of the fact that user stories are refined feature definitions that can be covered in paper tests. Constantine (2002), Hudson (2003), Hussain, Milchrahm *et al.* (2009), Williams and Ferguson (2007), Fox *et al.* (2008), Hussain, Lechner *et al.* (2008), Ungar (2008), and Miller (2005) recommend that usability evaluations could be conducted through paper inspection of prototypes, but only to refine it for the next iteration. Albisetti (2010) reports that, in his project, the developers performed usability reviews and that this completely changed the way they appreciated the work of the interactivity designers.

Mohler *et al.* (2003) present an experimental design, based on web maps, to try to answer the question of which type of interactive control works best for interactive content. The study found a significant difference between

a *joystick/trackball* type interactive control versus two different control mechanisms based on multidirectional buttons. The results indicated that shorter response times are obtained with the *trackball* control. Although this work focused on map-based content, the results have applicability to other types of content, and the quantitative approach used provides a framework in the fields of usability and interface design for interactive content.

According to Greenberg and Colbert (2003), while delivering the best content in the classroom is not rocket science, it does require a particular set of skills and methodologies for its design. And, because the technology is so new and in some cases misunderstood as a medium, the paucity of quality remains a mole in interactive content. As a result, there is still much work to be done, especially by organizations wishing to package their knowledge for delivery. As a contribution to this area of knowledge and as a result of a series of interviews with content providers, users, and marketers, they propose a best practice guide for designing and implementing interactive videoconferencing. It is also based on their own experiences of participating in distance learning processes.

For Hussain, Lechner *et al.* (2008) the success of an interactive content project is associated not only with tools and technologies but also depends on a user-centered development process. To achieve this goal, they propose the use of agile practices promulgated from Extreme Programming (XP). They develop a multimedia *streaming* application for cell phones that allows searching for audio and video content in large databases and then playing it on a cell phone virtually anywhere, anytime. They emphasize iterative UI development by involving UI designers, development engineers, and end-users, guided by agile practices. On the other hand, Jorgensen (2005) provides a high-level description of best practices for interactive

content design and creation. She presents a complete description of the process from business considerations, planning processes, and development, incorporating related best practices. Although it cannot be considered an instructional document, because it assumes that readers have at least a basic understanding of how to structure and design such content, it is a useful guide to put into practice.

Huang (2005) states that pressure from administrators and students means that teachers must use modern technologies to address their learning needs and expectations. However, they need more support and adequate training to adopt these new approaches. To collaborate on a solution the author provides guidelines on best practices for designing interactive content: 1) understand the learning problem and user needs; 2) design the content to take advantage of enabling technologies; 3) build multimedia materials with web style standards and human factors principles; 4) assess the user; and 5) evaluate and improve the design. Meanwhile, Miyazaki *et al.* (2006) propose a concept for developing a best-practice support system for interactive content creation based on 3D computer graphics. A content creator for the description of a script, using two types of files prepared by the system, can be easily used to create these scenes and also control the user-system interactions. Focusing on the creation of interactive content using 3D, the authors develop an authoring system through best practices. Its most important feature is that it prepares and installs various types of functions and makes it possible for users to easily manage them through a simple *scripting* language.

Thorndyke (2008) provides an in-depth exploration of the literature on best practices for designing interactive Web sites. The review provides a solid foundation of suggestions on how to use best practices to create better user experiences. Research on the topic suggests that companies should set up

e-commerce features that allow customers to request information through mailing lists and e-newsletters, provide forums for feedback, create a social media presence, and remain transparent. In this regard, the United States Department of Labor (2011) publishes a document with the objectives of 1) explaining the analysis and design phases for developing, implementing, and evaluating interactive content; 2) providing a recommended structure; 3) presenting best practices for design; and 4) explaining the Kirkpatrick model of evaluation and providing recommended strategies. Following these guidelines, they develop a training course/program, organized coherently to increase content retention, keep the audience engaged, and reinforce lessons learned.

Nakamura and Miyashita (2012) propose how to structure and design a device to add electronic flavor to food and drink. This flavor is a characteristic taste that is produced when the tongue is electrically stimulated. From a set of specific best practices, these researchers develop an interactive system for synchronizing video content using electronic taste reversibility and instantaneousness. To do so, they determined the presentation time based on the different latencies for the perception of each sense and measured the latencies for electronic taste and visual stimuli, as a basic evaluation for an interactive content presentation system in which they synchronize electronic taste and visual content. Bergen (2014) presents a series of recommendations and best practices for designing and developing interactive content. His explanation is based on *shoppable* videos (a video on the Internet that allows viewers to buy products while watching it) but can be applied in many other related areas. He divides the practices into 1) introduction of interactivity, 2) pacing and structure, and 3) technical.

According to Derringer (2014), the recent rapid growth in the use of interactive content is

due to a confluence of factors such as dramatic innovations, lower hardware and software costs, and greater integration and ease of use. The point is that good development objectives must be structured and the cost that the client is willing to invest must be taken into account. So a practical approach is to deliver the right message to the right audience with the right vehicle: who are the right people to engage with the project? What information are they looking for? How long is the content expected to be used? The author presents a series of best practices for structuring, designing, and implementing interactive digital signage, which other companies have taken and applied to different interactive products. On the other hand, Clay (2009) presents a proposal of good practices to help teachers to structure, design, and evaluate learning through virtual courses. Through 11 recommendations, she describes a process in which the beneficiaries will be the students who take this type of course.

Webinars (online seminars) are a promising way to develop quality training programs with greater reach than traditional face-to-face sessions (Maine Commission for Community Service, 2010). Unfortunately, they often fail to live up to their potential because instructors are unable to achieve interactive training. Research shows that adults learn best when they are encouraged to relate the new material to pre-existing knowledge. But it also reveals that people only remember 20 % of the information they hear and 10 % of what they read. This paper discusses several principles, ideas, and concepts that instructors, trainers, and facilitators can use to create more interactive and collaborative content.

Analysis of results

The sample consisted of 100 papers distributed according to the information presented in Table 1. It should be clarified that

some papers relate several areas of interest in the search, so they can be located in more than one column. Column *I* lists papers that describe or propose good practices for designing *interactivity*, column *A* lists papers that describe or propose good practices for developing *agile principles*, column *E* lists papers that publish good practices for structuring, designing, and evaluating interactive content, and column *R* list papers that relate interactivity or agility to some area or discipline. According to this

distribution, it can be determined that the interest of researchers is to present their results directly to the community through articles and papers in events because in this way they receive feedback in less time. In addition, the general conviction is that peer-reviewed papers have greater credibility and quality. The number of *online* papers is striking, but a review of the responses and follow-up to these contributions shows that it is low.

Table 1. Distribution of the papers in the final sample

Type of publication	Quantity	I	A	E	R
Articles					
Books					
Book chapter		21	24	47	20
Presentations					
Online					

Source: The authors.

Answer to the research questions

To answer the questions, a grouping was made of the best practices disseminated to avoid presenting extensive lists. The procedure consisted of summarizing those that were common to most of the works, both

for interactivity and agile, and for structuring, designing, and evaluating interactive content.

What are the best practices published in the literature regarding interactivity and agile? Table 2 presents a summary of the most common good practices found in the sample documents.

Table 2. Best practices from interactivity and agile

Interactivity	Agile
<ul style="list-style-type: none"> • Integrate all stakeholders into the work team. • Modeling and simulation • Determine clear and achievable objectives according to the area of application. • Adequately motivate stakeholder participation • Adequate working infrastructure • According to the audience, take into account appropriate levels of communication. • Implement permanent feedback processes • Parallel design of the evaluation system and simulate it. • Evaluate target achievement • Design for every audience • Do not universalize interactivity • Re-knowing the actors • Analyze previous experiences • Always use state-of-the-art technology and beyond • Envision possible future scenarios • Determining and enforcing design life • Withdraw in time 	<ul style="list-style-type: none"> • Document all activities, phases, and procedures. • All processes must be iterative. • Prototyping • Recognize and leverage the skills, abilities, capabilities, and knowledge of each team member. • Designing from user stories • Structure and execute tests parallel to the development. • Validate requirements, interfaces, and designs through observation, measurement, and recording. • Design and develop as comprehensive as possible. • Building scenarios • Refactoring • Simulate delivery times. • Short development cycles • Keeping the work team motivated • Continuously measure project progress • Respect the standards of the specific area. • Integrating all stakeholders from the early stages of the project • Re-know every error and document it • Maintain and promote two-way communication

Source: The authors.

In what areas or disciplines do the authors apply interactivity or agile? As shown in Table 1, most of the papers in the sample report on interactivity or agile, but from the

perspective of describing application areas or disciplines. Table 3 shows the summary of what was found in the analysis.

Table 3. Areas or disciplines of application of interactivity and agile

Interactivity	Agile
<ul style="list-style-type: none"> • Virtual reality • 3D design and animation • Multimedia • Film and TV • e-Learning • Classroom, virtual, and distance education • Marketing • Advertising • Astronomy • Physics • Paleontology • Medicine • Engineering 	<ul style="list-style-type: none"> • Software development • Organizational management and administration • Project management • Business intelligence • Curriculum • Industrial engineering • Software engineering • Marketing

Source: The authors.

What are the best practices proposed for structuring, designing, and evaluating interactive content? Although no papers were found that specifically describe good practices

for structuring, designing, and evaluating interactive content, Table 4 lists those that, in the authors' opinion, have some relation to this purpose.

Table 4. Best practices for structuring, designing, and evaluating interactive content

Structure	Design	Evaluate
<ul style="list-style-type: none"> • From prototypes • From feasible scenarios • Starting with user stories • Taking into account current socio-technological developments • Re-understanding the end-user • As a team • According to the target audience • Not universal • Documenting the entire process • With state-of-the-art technology • Respecting the standards and norms of each area. • Taking into account the costs 	<ul style="list-style-type: none"> • From modeled, validated, and simulated prototypes • Simulate and model from feasible scenarios • Taking into account usability factors • Experimentally • Immersing the audience • As a team • User-centric • Documented the entire process • With state-of-the-art technology • Taking into account the moods of the audience • Maintaining a steady pace 	<ul style="list-style-type: none"> • Iteratively • Instructional achievement • Results vs. user stories • Individually and in groups • Documenting the entire process • Outside the traditional models • Focused on achievement • With future projection • Thinking about continuous improvement • In an agile and objective manner • With feedback

Source: The authors.

Validation/denial of the hypothesis

This research is based on the hypothesis that *the best practices disseminated in the literature are sufficient to design efficient and effective interactive content*. After analyzing the results of the research, case studies, and experiments published by the authors, it is concluded that the best practices presented are indeed sufficient to achieve this objective. But, because the authors do not present *universal* practices, most of them are only applicable to the specific area in which they experimented. More generalized best practices are needed so that designers and developers of interactive content can use them indistinctly to structure, design, and evaluate content in any area.

Conclusions

This review has aimed to highlight some important contingent good practices that make both interactivity, and agile attractive, and their benefits for working on interactive content. Given the results obtained, both the structuring and the design and evaluation of these contents should probably proceed inductively, using the specific results of the studies analyzed to reach general conclusions. But, as with other related research, these efforts should be user-centered, so that new knowledge can be built around the pattern of impact on the user, rather than around ever-changing technological developments. By delineating the concept of interactivity and the contributions of agile, it will be convenient in the future to use both principles to mediate and localize user experiences with technology and come to an agreement on the definition and use that will benefit any area that requires them. In addition, by transitioning the research to a more programmatic phase, many of the speculative hypotheses can be supplanted

by a more realistic set of verifiable results that guide and shape the process of a theoretical construct.

The results of the present study show that good practices from interactivity and agile are widely disseminated in the literature and that researchers apply them permanently in their experiments and validations. In the process, it was found that very few, if any, of the works in the sample integrate the practices of both areas to work on their proposal or experience. Furthermore, although it was not the objective, the authors found that it was not so easy to find a definition for good practices that would be widely accepted, which led to an additional article on the subject. But, according to the analysis of the works on interactivity and agile, and apart from this drawback, it was possible to answer each of the questions raised in the research, while describing the best practices disseminated to structure, design, and evaluate interactive content.

The use of interactivity as a variable in research has increased dramatically with the emergence of new communication channels. Moreover, since many scholars have overused the concept in their analyses and theoretical and operational definitions, most are scattered and inconsistent. Consequently, it is necessary to present a detailed explanation of interactivity, which generates consensus on a theoretical and operational definition. But it is generally accepted that interactivity is both a means of communication and a psychological factor that varies across communication technologies, communication contexts, and people's perceptions. On the other hand, although agile has had greater application and diffusion from software development, other areas and proposals were found in which researchers are making use of its practices. Related works are presented in which good agile practices are described for, for example, structuring marketing, management, and administration plans and projects, and for

planning, designing, and developing products from industrial engineering.

On the other hand, the integration of best practices from interactivity and agility requires different levels of planning and collaboration between researchers in both areas of knowledge. Unfortunately, these types of initiatives are rarely communicated and become the work of isolated teams in protected environments. Research such as the one presented here revolutionizes the context in which it takes place, playing an important role in disseminating and proposing knowledge that can be used in many different areas and disciplines. Being able to integrate good practices from both areas is a milestone that so far has no comparison in the literature, which has allowed the researchers to reaffirm

the importance of completing the project and achieving the objectives set.

As future work, and as a product of the same research project, it is expected to disseminate a broad analysis of the concept of interactivity (seeking a general definition, defining its levels, and specifying its advantages and disadvantages), discriminate agile as a principle that can be used in many other areas of production and development, and propose general good practices for structuring, designing and evaluating interactive contents. These contributions may serve as a basis for other areas of knowledge to enhance and experiment them in the projects they carry out, mainly oriented to make visible the potential of merging interactivity and agile in the design of interactive content.

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