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The International Journal of Management Education

journal homepage: www.elsevier.com/locate/ijme

Experiencing with *visuals* in accounting education: The case of integrated reports

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ARTICLE INFO

Keywords:

Visuals
Accounting education
Integrated reporting
Resource map
Advance organizer

ABSTRACT

In addition to the increasing use of visual tools (e.g., maps, graphs, images) in accounting, a growing literature is advocating more research on how visuals can also act as teaching aids to facilitate accounting education. This request particularly concerns the models of corporate reporting providing a multi-dimensional representation of organizations, such as integrated reporting, due to their greater complexity in comparison to traditional accounting reports. This article addresses such request by specifically investigating the potential of using visuals to support the students' learning of integrated reports by making the multi-dimensional content of these reports more accessible to learners. To achieve this aim, the article relies on Ausubel's meaningful learning theory and focuses on the use of a specific visual, named "resource map". This visual was particularly studied with two group workshops, whose participants were involved in developing a resource map from the information of an integrated report. Our findings show that the use of visuals such as resource maps can support the teaching of integrated reports by helping learners to understand the main principles underlying these reports and acting as an 'advance organizer' of the data and information describing the multi-dimensionality of organizations.

1. Introduction

Visuals (e.g., maps, graphs, and images) have long been used in the accounting field to display information in corporate reports (e.g., Falk et al., 2016; Mouritsen et al., 2001; Preston et al., 1996), and as teaching aids in accounting education (e.g., Duffy, 1990; Leaby & Brazina, 1998; Phillips et al., 2012), as well as in the broad areas of business education (e.g., Somers et al., 2014) and management training (e.g., Rivo-López et al., 2022).

However, additional research on the use of visuals is still required for the comprehension of the recent models of corporate reports (Bell & Davison, 2013; Davison, 2015), such as integrated reports (IIRC 2013a and, 2021), due to their increasing complexity. Indeed, if "the practice of accounting is complex and varied" (Marriott & McGuigan, 2018, p. 549) due to the different actors (i.e., organizations, professional bodies, politicians, etc.) using and viewing accounting information in several ways (Hopwood, 1994), the complexity of corporate reports increases with the attempt of providing a full representation of the "complex and multi-dimensional realities" of organizations (Morgan, 1988, p. 480).

The topic is of great interest to accounting scholars since, in recent years, several studies have investigated the use of new corporate reporting models (e.g., Azam et al., 2011; Buallay et al., 2021), and particularly of integrated reporting (e.g., Adams, 2017; Eccles &

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<https://doi.org/10.1016/j.ijme.2023.100809>

Received 29 June 2022; Received in revised form 17 March 2023; Accepted 23 March 2023

Available online 2 April 2023

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Saltzman, 2011; Giorgino et al., 2017), to manage the multi-dimensional aspects of organizations. However, even if on one side the adoption of integrated reports is quickly spreading (e.g., see De Villiers et al., 2020; Robertson & Samy, 2015), and it is included in an increasing number of accounting curricula (Adhariani & De Villiers, 2019; Owen, 2013), on the other side, an issue emerges for this adoption since users are said to not understand fully the comprehensive and multi-dimensional information on the organization's value creation processes provided by integrated reports (e.g., Du Toit, 2017; Stone & Lodhia, 2019). This issue therefore incentivizes searching for additional techniques that could support the understanding of the additional information provided by these reports (if compared to traditional financial reports).

To address the issue aforementioned, this study particularly aims to investigate the potential of using visuals to support the students' learning of integrated reports and the related multi-dimensional content more accessible to learners.

To achieve this aim, this study relies on Ausubel's "meaningful learning theory" and the related concept of "advance organizer" (Ausubel, 1960, 1963 and, 2012) to discuss the features and results of studying integrated reporting by using a specific visual tool named "resource map" (Barnabè et al., 2019; Giorgino et al., 2020; Kunc & Morecroft, 2009). A resource map is a useful tool because it exploits the similarities existing between the concepts and ideas of integrated reports and the principles of the Dynamic Resource-Based View (hereafter DRBV – Barnabè et al., 2019; Kunc & Morecroft, 2010). We tested the use of resource maps through two group workshops (Valcourt et al., 2020) involving different learners (i.e., professionals and post-doctoral students) in the active creation of a resource map based on the information provided by an integrated report.

This study contributes to the stream of research about the use of visuals in accounting education in three main areas.

- (1) Students learn how to adopt an orderly scheme to view the holistic representation of the value creation process provided by an integrated report following the principle of connectivity and interrelatedness among the key elements of resources, business activities, and results. In that sense, visuals such as resource maps act as a platform to connect and organize the fragments of texts extracted from the report in a comprehensive multi-dimensional information environment (Mayer, 1979). Stated differently, pieces of information originally dispersed across an accounting-based document are now reorganized and connected in the resource map.
- (2) Students learn the dynamic dimension of the organization's value creation process through the causal linkages and feedback loops visualized in the resource map, thereby transforming the "static information" of the report "into active knowledge" (Hyerle, 2009).
- (3) The study provides the methodological steps to effectively use visuals in practice as a method to increase understanding of the multi-dimensional business under analysis (e.g., Davison & Warren, 2009; Gauntlett & Holzwarth, 2006). Specifically, by explaining the connectivity among business elements in a causal and dynamic perspective, visuals may contribute to educating aware students, who will be able of using the information provided by integrated reports to effectively evaluate the trade-offs and consequences of organizations' decisions (Caglio et al., 2020).

This article is structured as follows. The second section focuses on the debate about the use and role of visuals in the accounting field and specifically for accounting education. Subsequently, the third and fourth sections respectively introduce the interpretative scheme adopted for the analysis, i.e., Ausubel's meaningful learning theory, and the similarities between integrated reports and resource maps justifying the choice of this visual tool. The fifth section presents the research design, while sections 6 and 7 present the results and the discussion of our analysis. Limitations and some ideas for further research conclude this study.

2. Using visuals in the accounting field

2.1. Visual representations in corporate reports

In recent years, visual representations (in this study, simply "visuals") have been increasingly used by organizations of any size and industry to convey information to stakeholders (Preston et al., 1996), particularly about intangible assets such as corporate identity (Ditlevsen, 2012), or intellectual capital (; Davison, 2014; Mouritsen et al., 2001).

Graphs, maps, and images are massively used in corporate reports as an additional and complementary form to qualitative textual descriptions and/or quantitative data to communicate information about business activities and performance achieved (Beattie & Jones, 1997; Falk et al., 2016; Preston et al., 1996). A visual approach to reporting involves the need to go beyond verbal text (words) and include a variety of information presented to the reader in different forms. In the field of accounting, the benefits of relying on visuals are said to be many and different (Bell & Davison, 2013). For example, graphical images and maps are recognized to be particularly useful to communicate concepts and information in an alternative and more direct way to a variety of stakeholders (e.g., decision-makers, investors, and customers), since how data are presented and organized affects performance evaluations about the organization (Cardinaels & van Veen-Dirks, 2010). Stated differently, using visuals broadens the stakeholders' knowledge about the organization, the degree of transparency about its value creation processes, and the content of its disclosure (e.g., Busco & Quattrone, 2015; Kaplan & Norton, 2004) far beyond what is usually provided and disclosed in traditional reports (Simpson, 2000).

As a consequence of their increasing use in corporate reports, visuals certainly represent an important topic of research in the accounting field (e.g., Davison, 2014; Davison & Warren, 2009; Greenwood et al., 2019; Quattrone, 2017). Previous studies have particularly regarded visuals as powerful tools to assist organizations in situations characterized by a lack of information sharing and the presence of knowledge opaqueness about the linkages between actions and results (Jørgensen & Messner, 2010). Visual tools can be adopted to reduce the effort required to understand information (Bertin, 1983) and to improve the presentation of accounting

information (Libby, 1981), particularly when a multiple-dimensional representation of organizations' performance is required (Jackson, 2008) and also social and environmental information has to be taken into consideration (Arjaliès & Bansal, 2018). Moreover, visual representations overcome the deficiencies inherently embedded into accounting "inscriptions", such as incompleteness and simplification (Busco & Quattrone, 2015), and allow going beyond the mere calculative process that traditional accounting tools and practices entail (Hopwood, 1992), thereby favouring engagement and literacy among students through visual pedagogy (Goldfarb, 2002).

Within the "entirely new horizon of investigative possibilities for the accounting research community" offered by visuals (Parker, 2013, p. 21), however, this study particularly relies on the possibilities suggested for the adoption of visuals in the field of accounting education (e.g., Sithole et al., 2021; Wynder, 2018), as better explained below.

2.2. Adopting visuals in accounting education

Different scholars have suggested benefits related to adopting visual tools as teaching aids (e.g., Osgerby et al., 2018; Simon, 2007). By relying on the complexity of accounting as a practice aimed at representing multi-dimensional realities through "limited and incomplete" constructs (Morgan, 1988, p. 480), these studies have particularly emphasized the potential of visuals to make accounting more accessible to learners by developing a "creative environment for learning" (Marriott & McGuigan, 2018; McGuigan & Kern, 2015). Indeed, using visuals may support creative approaches to learning by expanding the students' capacities of formulating innovative ideas, forming mental flexibility, and thinking about a complex topic "in a global, holistic sense" (Mento et al., 1999, p. 391). These approaches are very useful to teach accounting since imagination and creativity help learners "to look beyond accounting numbers" and engage in the learning process (Hines, 1988, p. 256), thereby also increasing their performances (Sithole et al., 2021).

Previous studies have analysed the use of visuals to support the understanding of accounting concepts such as the relationship profit-cost-volume or interest capitalization (e.g., Duffy, 1990; Leauby & Brazina, 1998; McCann, 2016). Other studies have pointed to the increasing adoption of visual representations in accounting textbooks (Phillips et al., 2012), and have tested the effectiveness of learning with visuals as tools to enhance powerful communication and emotional impacts on students (Kienzler, 1997), stimulate a personalized learning approach to accounting (Aaltola & Manninen, 2021), and achieve students' satisfaction (Elliot, 2002). When directly developed by students, besides representing the cognitive items and relationships describing the reality under investigation, visuals contribute to implementing text processing and developing new ideas, thereby favouring the comprehension of a specific reality (e.g., Davison, 2015; Davison & Warren, 2009; Gauntlett & Holzwarth, 2006).

Using visual representations, such as concept maps or visual metaphors, helps to assimilate new knowledge by connecting new information with the learner's previously-attained cognitive structure (e.g., Osgerby et al., 2018; Schwendimann, 2015; Simon, 2007). Moreover, when applied to accounting topics, visuals can be more effective than the traditional instruction method (Leauby et al., 2010; Mass & Leauby, 2005), and make accounting more accessible to learners (Marriott & McGuigan, 2018), mainly when created under the guidance of educators (Schwartz, 2020; Shimerda, 2007; Simon, 2007) and in a collaborative environment (Sithole et al., 2021).

Beyond the evidence provided by this literature, however, the potential of using visuals in accounting education remains an open question, since some doubts raised by scholars in the past have not yet been resolved. For instance, some studies have highlighted that, beyond their potential, visual tools do not always represent the relevant learning preference of accounting students (e.g., Bracci et al., 2020), thereby fuelling the debate about how aligning this preference with the visuals and learning conditions to be provided to students (Visser et al., 2006). Moreover, other studies have asked for more research on the inclusion of different visual tools in the learning practices of accounting educators (Wynder, 2018), and on "the benefit from the use of visual material as teaching aids" (Davison, 2015, p. 29) to make corporate reports more accessible to accounting students and researchers.

Within this context, additional research is particularly required to understand the potential of visuals in improving the effectiveness of how accounting contents are delivered when multi-dimensional information must be addressed (Velte & Stawinoga, 2017). This is the case of the recent model of corporate reports relying on the Integrated Reporting framework (IIRC, 2013a and, 2021), which provides financial, social, and environmental information on organizations' activities and performances in one report (Azam et al., 2011; Eccles & Krzus, 2011), not without consequences for its users. Indeed, the "financial reporting environment is increasingly rich and complex" not only due to the different agents involved in the preparation of corporate reports but also because of the growing amount of information provided in the form of "narratives" (Beattie, 2014, p. 112; Roslender & Nielsen, 2017). This term mainly refers to the words (and, eventually, also to the graphs, photos, tables, and charts) adopted to integrate financial data with social and environmental information in corporate reports. Unfortunately, previous studies have highlighted the difficulty of reading and understanding narrative-rich reports (e.g., Courtis, 2004; Smith & Taffler, 1992) due to the many pieces of information to be analysed and the limits of the verbal "linear, non-reversible, one-dimensional" representation of information (Tufte, 1990, p. 31).

As anticipated, this difficulty particularly concerns integrated reports, which are considered the latest and more innovative step in the corporate reporting landscape (Nicolò, Ricciardelli, Raimo, & Vitolla, 2021). Recent studies have indeed emphasized the limited level of readability of these reports (Du Toit, 2017), whose wide use of narrative disclosure, while compromising the conciseness of the information provided (Melloni et al., 2017), is frequently affected by syntactical complexity (Stone & Lodhia, 2019). Moreover, since the reading difficulty and verbosity of integrated reports impact negatively the economic benefits of the choices relying on these reports (Caglio et al., 2020), previous studies have emphasized the necessity of intensifying the accounting education related to integrated reports and their multi-dimensional information on the organization's value creation processes (Velte & Stawinoga, 2017).

To contribute to this debate, this study particularly aims at investigating the potential of using visuals to support the students' learning of integrated reports by making their multi-dimensional information more accessible to learners. To achieve this aim, this

study relies on Ausubel's theory and the concept of "advance organizer", which are explained in the next section.

3. The interpretative approach

When studying the use of visuals in the accounting field, previous research has advocated the adoption of practice-oriented theories (Bell & Davison, 2013; Davison, 2015), which emphasize the 'dynamic Becoming' rather than the 'static Being' (Kavanagh, 2004, p. 448) potential of visuals. In these theories, visuals are interpreted as "nonlinguistic symbol systems used by learners [...] for graphically linking mental and emotional associations to create and communicate rich patterns of thinking [...] *transforming static information into active knowledge*" (Hyerle, 2009, p. xix). This definition builds on the constructivist perspective, which emphasizes the central position assumed by learners in the educational process (Papert & Harel, 1991). In this perspective, the learners' role is specifically converted from passive recipients to active experimenters adopting innovative teaching aids such as visuals (e.g., Jones et al., 2017; Roberts, 2002).

In addition to the constructivist perspective, we argue that, when studying the potential of visuals in accounting education, helpful insights can be provided by Ausubel's "meaningful learning theory" (Ausubel, 1960 and, 2012).

Ausubel was an American psychologist that conceptualized the efficacy of developing learning processes based on the student's involvement in building knowledge through experience (Vargas-Hernández & Vargas-González, 2022). By highlighting the inefficiency of rote learning (i.e., the mechanical memorization of information in isolated cognitive compartments of learners), Ausubel specifically assimilated knowledge to an integrated system where ideas are linked together in an orderly way according to the logical rules of the human mind as in a Chinese puzzle box (Ivие, 1998). In this system, ideas and concepts are structured within wider 'containers' like smaller boxes are hidden inside larger boxes. The result is a cognitive structure that "is hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive sub-concepts and informational data" (Ausubel, 1960, p. 267).

Realizing this structure requires that learners, after having understood the meaning of the new contents, are able of connecting them with previously acquired concepts and ideas, thereby expanding their knowledge. Existing cognitive structure strongly affects the learning and retention of the new meaningful content since it reflects "an individual's organization, stability, and clarity of knowledge in a particular subject matter field at any given time" (Ausubel, 1963, p. 217). Learning environments based on collaborative processes may consequently favour meaningful learning since interaction and collaboration increase the students' capacity of understanding meanings and discovering connections among concepts. Stated differently, meaningful learning relies not only on learners' experience but also on interaction with other students, therefore knowledge represents "the product of an active, integrative, interactional process" (Ausubel, 2012, ix).

In this process, teachers assume the role of facilitators since, besides stimulating the student's interest in the subject, they favour the settlement and maintenance of the learning environments supporting students' action and collaboration (Vargas-Hernández & Vargas-González, 2022). Moreover, teachers may prepare students for the learning process by introducing them to a means facilitating the integration of new meaningful concepts with existing cognitive structures. Ausubel defined such means as an "advance organizer" aimed at "bridging the gap between what the learner already knows and what he needs to know" (Ausubel, 2012, p. 11). Mainly when the existing cognitive structure contains too general and insufficient information to allow the effective anchorage of the new concepts, an advance organizer is a platform playing "a mediating role" between previous and new knowledge. In detail, an advance organizer presents the new concepts by using abstract ideas that are related to the subject, but with a level of generality and inclusiveness that is higher than what is to be learned, thereby favouring the assimilation of additional information upon what is already known (Ivие, 1998). Consequently, it has to be introduced by teachers before the new meaningful concepts are learned: understanding the information included in the advance organizer and particularly the connection between its abstract ideas and the new concepts, may support students in learning complex materials. Advance organizers specifically furnish this support by providing "ideational scaffolding for the stable incorporation and retention" of these materials (Ausubel, 2012, p. 149). However, how they make this provision allows the distinction of two categories of advanced organizers, i.e., "comparative" and "expository" organizers (Ausubel, 2012, pp. 62–63). The former is used to clarify the similarities and differences existing between the set of ideas/concepts to be learned and the set of similar ideas/concepts already present in the cognitive structure of students. Comparative organizers consequently act as both reminders, to recall the previous information that is relevant for the anchoring integration of the new materials, and discriminants, to avoid confusion among similar concepts. The latter is instead used for relatively unfamiliar materials to facilitate the anchorage of these materials to "relevant proximate subsumers" provided by teachers (Ausubel, 2012, p. 149). These subsumers essentially work as a superordinate set of ideas/concepts to which including the new complex materials.

Since also integrated reports represent complex learning materials as previously emphasized (e.g., Du Toit, 2017; Stone & Lodhia, 2019), this study adopts Ausubel's theory and the related concept of advanced organizer to investigate the potential of using visuals to support the student's learning of these reports. To this aim, we focused our analysis on the use of a visual tool (i.e., resource map) presenting some conceptual similarities with the integrated reporting framework. The main principles of this framework and the deriving similarities with the fundamentals of a resource map are briefly introduced in the next section.

4. Developing learning of integrated reports through a resource map

4.1. A brief overview of integrated reporting

The main goal of an integrated report (hereafter IR) is to provide meaningful, integrated, and comprehensive information about an

organization's value-creation processes (Adams, 2017; Eccles & Saltzman, 2011). According to its framework (IIRC, 2013a and, 2021), an IR provides a holistic and comprehensive representation of an organization's key resources, business activities, and results, thereby comprehensively considering and describing the organizations' value creation dynamics over the short-, medium-, and long-term. In broad terms, the goal of an integrated report is to inform the organization's shareholders and stakeholders about the value created through its business activities and using the inputs at its disposal (IIRC, 2013a). This goal inevitably challenges organizations to (re) present such information holistically and comprehensively (IIRC, 2013b). In this context, the IIRC framework (IIRC, 2013a) provides a few core principles, mainly the "connectivity of information" and the broad principle of "integrated thinking". Specifically, the "connectivity of information" represents the interrelatedness and dependencies among the different factors (e.g., the various resources, or financial and non-financial information) influencing the organization's capacity to create value over time (IIRC, 2013c). The principle of "integrated thinking" – that broadly underpins the whole integrated reporting process – is instead defined as "the active consideration by an organization of the relationships between its various operating and functional units and the capitals that the organization uses or affects" (IIRC, 2021, p. 3). Whereas these two principles seem to be clear, their operationalization raises some challenges, and previous studies have already underlined that more needs to be done to make such principles applicable in practice (e.g., Adams, 2017; Busco et al., 2021). It is noteworthy that IR represents an example of a hybrid document with a lot of narratives communicating simultaneously financial and non-financial information, qualitative content, and quantitative data (e.g., Bernardi & Stark, 2018; Busco et al., 2013; Dumay et al., 2016) and scholars have witnessed a great heterogeneity in terms of forms with disclosure formats and practices across companies, industries, and countries (e.g., Stolowy & Paugam, 2018) to the extent that concerns have also been raised about the actual comparability and consistency of integrated reports (Slack & Tsalavoutas, 2018).

Given the increasing relevance gained by this type of report, there is a need to analyse the issues related to the use of IR also from the perspective of accounting education and, more particularly, to identify the implications of introducing the study of IR in the accounting curriculum (Correa Ruiz, 2013; Owen, 2013). Additionally, previous studies have highlighted the need for further investigating how IR is taught and used in class. This is especially motivated by the fact that students seem to be not familiar with: integrated reports (Velte & Stawinoga, 2017); the challenges faced by organizations in preparing these documents (Bouten & Hoozée, 2015); and the modalities through which connecting data and information about capitals and measures in the reports (McNally et al., 2017).

As anticipated, to contribute to this debate, we decided to investigate the potential of using visuals to facilitate the teaching of IR by referring to the visual tool named resource map given the similarities of concepts and ideas underpinning IR and resource maps (e.g., Barnabè et al., 2019), as summarized below.

4.2. The fundamentals of resource mapping

A *resource map* is a graphical tool that assists organizations in visualizing the key strategic resources at their disposal, the connections among these resources, and the overall pattern of value creation (Kunc & Morecroft, 2009). From a graphical point of view, resource maps can be viewed as a typology of stock and flow diagram (Sterman, 2000), whereby the selection of the stocks and flows included in the map (and the causal relationships connecting such variables) is informed by available financial and accounting information.

The related modelling technique, i.e., *resource mapping*, uses the fundamental concepts of the stream of research named *Dynamic Resource-Based View* (DRBV), which combines the key elements of the Resource-Based View of the Firm (RBV – Barney, 1991) and the System Dynamics methodology (SD) (Forrester, 1961). On one side, RBV strongly emphasizes that an organization's performance is determined by the set of "resources" and "capabilities" developed or acquired over time; on the other side, SD offers a set of techniques and tools able to operationalize RBV concepts, thereby building qualitative maps and quantitative simulation models useful not only in business, social, and sustainability-related systems (e.g., Ford, 1999; Sterman, 2000) but also in educational programs focused on such domains (e.g., Kunc, 2008 and, 2012). Resource mapping also overcomes some of the weaknesses of other SD-based tools, such as causal loop diagrams, especially in terms of understanding the dynamic complexity of organizational systems (Giorgino et al., 2020; Kunc, 2018).

Previous literature has already underlined the various strengths of resource mapping. For example, in the business domain, resource maps may effectively assist organizations to visualize their strategy (Kunc & Morecroft, 2009 and, 2010) and the fundamental architecture according to which the specific business system operates (Warren, 2008). Thus, resource maps allow both demonstrating

Table 1
Similarities of concepts between integrated reporting and resource mapping.

Concept	Integrated reporting	Resource mapping
<i>Representation of organization</i>	Capitals, business activities, outputs, and outcomes	Resources (stocks), capabilities and actions, distinctive firm performance
<i>Interrelationships</i>	Inputs and outputs, connectivity, feedback	Inflows and outflows, causal linkages (with polarities), feedback loops (positive and/or) negative
<i>Performance dimensions</i>	Financial, manufactured, intellectual, human, social and relationship, natural	Financial, social, environmental
<i>Visual Narratives</i>	Tables and infographics Verbal with supporting tables and infographics	Map representing the multi-dimensional information Graphic with supporting verbal of the main feedback loops and connections

graphically the complexity existing in business models and evaluating organizations' value creation through the analysis of the feedback processes represented (Kazakov & Kunc, 2016). These strengths also translate into the education domain, with resource mapping being considered an effective tool to facilitate teaching and support learners in different educational contexts and for various learning aims (e.g., Kunc & O'Brien, 2017; O'Brien et al., 2011).

In more detail, resource mapping has strong similarities with the underpinning concepts of integrated reporting as summarized in Table 1 (Barnabè et al., 2019; Giorgino et al., 2020).

Overall, resource mapping allows operationalizing the main principles underpinning integrated reporting (i.e., connectivity of information and integrated thinking) through a rigorous language, a structured mapping process, and a set of technical concepts ready to be used in class and with the students. In detail, from an educational point of view, the joint use of a resource map and an integrated report is also meant to stimulate learners to filter, connect, and reorganize existing information (from the reports) and knowledge (individually owned and shared with others) through the language provided by resource mapping (Barnabè et al., 2019; Kunc & Morecroft, 2010).

5. Materials and methods


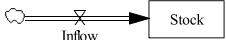

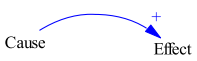
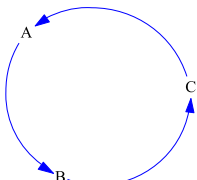
5.1. Participants

The study involves – as learners – professionals and post-doc students with a major in accounting for three main reasons. First, these learners had different backgrounds and prior levels of expertise and knowledge in the accounting domain (Mortensen et al., 2012). Second, these learners had some prior knowledge about IR, however with a narrow scope of use. In detail, the professionals were more accustomed to “using” an IR in practice to retrieve data, while Ph.D. students were more inclined to study IR practices to understand the disclosure of information by companies operating in specific industries. Hence, all the participants were not accustomed to the in-depth development and analysis of IR, which is a similar condition found in an accounting course. Third, we selected these groups of learners since they are driven in their reasoning (e.g., Torres et al., 2017) and behaviour (e.g., Montmarquette et al., 2004) by different factors.

5.2. Instrument

The participants in the workshops were required to generate a resource map having as the starting point the integrated reports from two international companies operating in two different industries, i.e., the oil and gas industry (2015 Integrated Report by ENI) and the airline sector (2019 Report by Japan Airlines). This choice was justified by two different motivations. First, the industries selected represent two well-studied sectors in terms of sustainability and reporting practices, also due to the potentially harmful externalities generated by their typical business activities (e.g., see Alazzani & Wan-Hussin, 2013, and Guenther et al., 2006 for the oil and gas

Table 2
Methodology to develop a resource map.

Steps of the process	Synthetic explanation	Visual representation
1. Lay out the resources	Identify the key resources included in the reports and visualize them as stocks (represented as boxes).	
2. Identify the processes (flows) responsible for building or eroding resources	Information and data are analysed to identify the processes which are responsible for growth or decrease dynamics in resources, i.e., inflows (arrows pointing to the stock) and outflows (arrows exiting from the stock).	
3. Identify capabilities	Capabilities are the activities that an organization performs. They are usually generated either from a single resource (i.e., A) or by the interaction of resources. Capabilities can build other resources, generate value by attracting customers, or generate activities influencing external stakeholders (e.g., B).	
4. Portray (direct and indirect) relationships and (positive and negative) polarities	This step requires drawing the causal links (depicted through connectors) which contain the direction and the polarity (“+” or “-”) of linkages. A positive link (+) means that if the cause increases, the effect increases above what it would otherwise have been, and if the cause decreases, the effect decreases below what it would otherwise have been. Contrariwise, a negative link (–) means that if the cause increases, the effect decreases below what it would otherwise have been, and if the cause decreases, the effect increases above what it would otherwise have been.	
5. Identify feedback loops (reinforcing and balancing)	The resource map is finished with the identification of the feedback loops between resources and flows. A feedback loop is formed when two or more variables are circularly connected, e.g., A affects B, then B affects C and ultimately C affects A determining a circular relationship between A-B-C. Feedback loops are recognized and labelled as either reinforcing (positive, generating growth) or balancing (negative, inducing stagnation).	

Source: Adapted from Kunc and Morecroft (2009) and Barnabè et al. (2019).

industry; Cowper-Smith & de Grosbois, 2011, and Eccles et al., 2012 for the airline industry). Second, analysing the results related to different industries and reports, we pursued the goal of obtaining data in a cross-industry-based analysis looking for similarities and differences (Eisenhardt, 1989). Table 2 outlines the steps recommended to build a resource map.

5.3. Procedure

Previous literature has discussed and demonstrated the motivations and potential benefits of organizing learners in groups. For example, Tempone and Martin (1999) demonstrated that group work (about accounting and management subjects) provides a collaborative mechanism that – through interactive debate and stimulation – ensures increased and developed knowledge. Rouwette et al. (2011) argued that building models within groups may positively impact participants' attitudes, subjective norms, and intentions. Peek et al. (1995) demonstrated that formal structured group methods may enhance students' active participation in the learning process of both themselves and their classmates.

The workshop format is suggested by the literature since it allows an active involvement of the participants favouring alignment and teamwork among them (Valcourt et al., 2020).

During each workshop, the participants were divided into small groups. The authors acted as *educators* during the initial and final stages of the workshop by running the plenary briefing, explaining all the steps required by resource mapping, and managing the debriefing phase (Crookall, 2010). Moreover, they operated as *facilitators* cooperating with the participants during the group mapping exercise to favour the interaction among them (Vennix, 1996).

Table 3 summarises the main features of the mapping exercise.

6. Results

This section presents the main results of the two group workshops according to the process outlined in Table 3 as well as some feedback gathered during the resource mapping exercise.

• Phase 1 – Basic Introduction about DRBV

Participants and educators discussed the basics of the DRBV methodology and formulated simple examples, such as the relationship between the availability of staff members and the number of tasks to be completed in due time (first workshop) or between the number of students enrolled and the availability of ICT equipment in universities (second workshop). Through these examples, the participants were involved in recognising, visualizing, and putting in context the fundamental concepts of resource mapping. More time and examples were needed for the comprehension of some concepts (such as flows) in comparison to other ones (such as stocks) for both groups of participants.

Table 3
Key phases of the mapping exercise.

Phase	Action	Description	Key concepts	Duration and teaching materials
1	Basic Introduction about DRBV	The fundamental concepts to be used during the workshop are introduced.	Resource, capabilities, causal links, feedback loops.	40 min Slides Examples are drawn on the blackboard
2	Focus on Integrated Reporting	The specific integrated report selected for the workshop is delivered. Participants are required to quickly inspect the report and subsequently focus on some sections of it.	Integrated Reporting framework Capitals, Business activities, Outputs and Outcomes, Value creation.	10 min Slides One full IR
3	Presentation of the resource mapping method	The steps of the resource mapping process are presented and described.	The five steps of the resource mapping process (see Table 2).	10 min Slides Examples are drawn on the blackboard
4	Resource mapping	Resource mapping starts. Participants are divided into groups of two and are required to go through steps 1–4 of the resource mapping process outlined in Table 2.	Resource mapping in practice, through resources, flows, capabilities, and causal links.	30 min Slides Hand-out displaying the whole resource mapping process Selected examples from the IR under analysis A3 sheets Pencils and pens
5	Debriefing and feedback	The resource maps drafted by the participants are analysed and discussed. Feedback loops are identified and some of them are displayed and commented on. Feedback is obtained from the participants.	Feedback loops and value creation patterns.	15 min Participants' resource maps Examples are drawn

• Phase 2 – Focus on Integrated Reporting

The participants identified the key data and information on which focusing the analysis within the full report, disclosed in the form of a selection of tables, verbal descriptions or excerpts, and numerical data (see Table 4). The full report of the organization under analysis was at the participants’ disposal during the entire workshop.

The information selected was fragmented and heterogeneous, thus requiring the identification of connections among sections. Subsequently, linkages and interplays among capitals, flows, capabilities, and performance indicators were tentatively identified and commented on. The identification of these connections was relatively quick for the participants analysing the ENI report, while it took all the time at their disposal for the analysis of the JAL report.

• Phase 3 – Presentation of the resource mapping method

The participants further expanded their understanding of the basic concepts of DRBV discussed during phase 1 and started to apply more rigorously the principles of resource mapping to the sections selected from the integrated reports (e.g., the participants drew causal linkages across the map and assessed polarities).

• Phase 4 – Resource Mapping

In the first step of mapping the participants had to lay out the resources, i.e., they were required to identify the key resources included in the integrated reports and visualized them like stocks. Fig. 1 depicts one “work-in-progress” (hereafter WIP) resource map drawn by one group of participants after this step. Notably, to increase their readability, all the figures were rearranged using the Vensim PLE Software (Ventana Systems Inc., 2006).

As shown in Fig. 1, starting from the integrated report, the participants from this group identified 14 capitals within this business environment. Notably, the participants depicted/labelled each stock with the colour/name of the category of capitals theorized by the Integrated Reporting Framework (IIRC, 2013a, 2021), as summarized by the legenda in Fig. 1 and by Table 5. All the six categories of capitals illustrated by the Integrated Reporting Framework (IIRC, 2013a, 2021) are recognized in this WIP resource map.

Colours were used to identify the information more clearly and straightforwardly. Notably, the participants included only a selection of resources that were mentioned in different sections of the integrated report under analysis.

Similarly, during the second workshop (focused on the airline industry), the participants from another group identified the core set of capitals at the organization’s disposal (see Table 6).

In the second step of the resource mapping process, the participants codified the information collected to recognize and represent the processes causing the resource growth or decrease, i.e., flows going in or out of the resources. Fig. 2 provides an example of the results obtained during this step.

During the third and fourth steps of resource mapping, the participants identified capabilities and portrayed (direct and indirect) relationships and (positive and negative) polarities. Table 7 presents two examples of causal links with the polarity added in the resource maps during the fourth phase of the two workshops.

In the first case, the polarity “+” clarifies that an increase in Investments would lead to an increase in Exploration activities. Similarly, a decrease in Investments would lead to a decrease in Exploration activities. In the second case, the polarity “-” clarifies that an increase in the number of Retirements, layoffs, and dismissals (in the company’s staff) would lead to a decrease in Service Quantity.

After the fourth step, the resource maps were almost complete (see Fig. 3 as an example of a WIP resource map drawn with some key resources, flows, and causal linkages).

In the fifth and last phase of the mapping exercise, the participants identified feedback loops (reinforcing and balancing) between resources, flows, and capabilities. In detail, the identification of feedback loops was made once the resource maps were completed, with the help of the educators during the debriefing. Fig. 4 presents a part of one resource map that was rearranged to portray feedback loops.

Focusing on the simplified map portrayed in Fig. 4, the participants – supported by the educators – identified several feedback loops within the resource map. As an example of how reading the figure, we can focus on the upper part of the resource map, where the first

Table 4

Sections of data and information from the integrated reports used in the modelling exercise.

Exercise 1 From the 2015 Integrated Report by ENI	Exercise 2 From the 2019 Report by JAL
<ul style="list-style-type: none"> - A table portraying the “Profile of the year” for this company, with financial as well as sustainability highlights and Key Performance Indicators; - a table portraying the main capitals, actions, outputs, and outcomes for the organization; - a figure representing upstream and downstream activities for this organization; - a map showing the connectivity of performances for the organization. 	<ul style="list-style-type: none"> - A figure portraying the value creation process for the company; - a table presenting an 8-year summary of financial data; - a selection of financial and non-financial data (“highlights”); - a table presenting 5-year ESG data; - a description of the company’s ESG management approach.

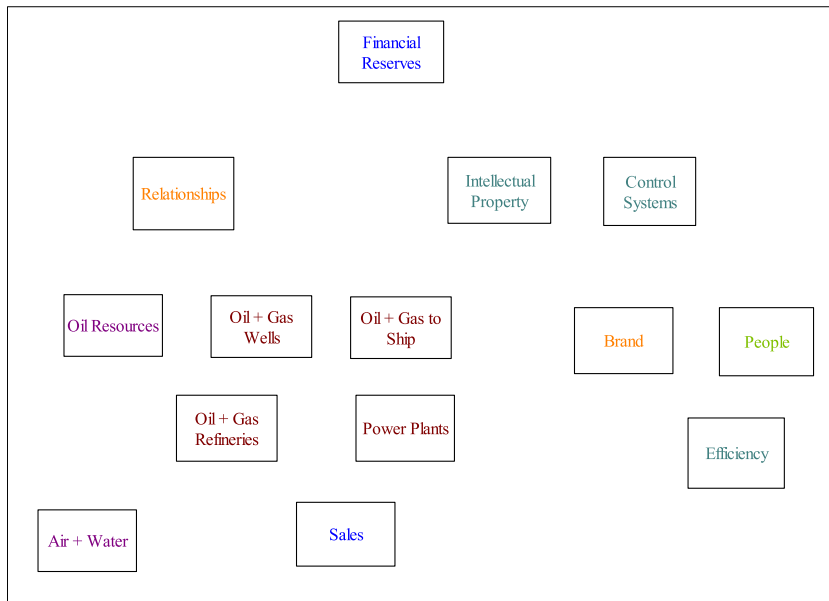


Fig. 1. WIP resource maps after step 1 (Workshop 1 - Group 1).
 Colour legenda: Blue – Financial; Dark Red – Manufactured; Petrol green – Intellectual; Light green – Human; Orange – Social and Relationship; Purple – Natural.

Table 5
 Capitals identified by the participants and categorized according to the IR Framework (Workshop 1 - Group 1).

Capital	Category of capital
Financial Reserves	Financial
Relationships	Social and Relationship
Intellectual Property	Intellectual
Control Systems	Intellectual
Oil Resources	Natural
Oil + Gas Wells	Manufactured
Oil + Gas to Ship	Manufactured
Brand	Social and Relationship
People	Human
Power Plants	Manufactured
Oil + Gas Refineries	Manufactured
Efficiency	Intellectual
Air + Water	Natural
Sales	Financial

Table 6
 Capitals identified by the participants and categorized according to the IR framework (Workshop 2 - Group 2).

Capital	Category of capital
Financial Capital	Financial
Fleet	Manufactured
Airports	Manufactured
Staff	Human
Social Relationships	Social & Relationships
Quality of Services Offered	Manufactured
ICT	Intellectual
Culture	Intellectual
Environment	Natural
Passengers	Customer (not owned by the company)

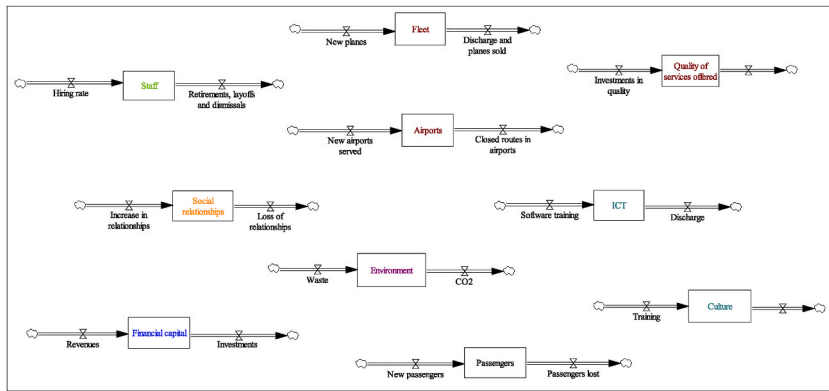


Fig. 2. WIP resource maps after step 1 (Workshop 2 - Group 2).

Table 7

Examples of causal links with the polarity within the resource maps.

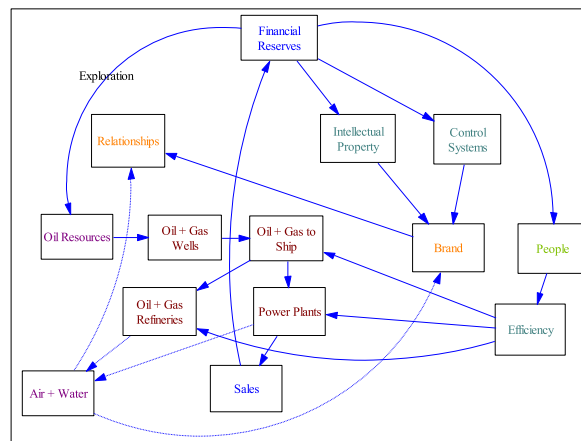
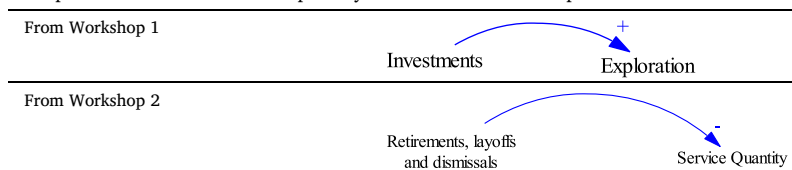


Fig. 3. WIP resource maps after step 4 (Workshop 1 - Group 1).

• Phase 5 – Debriefing and feedback

capital that is portrayed is Financial Reserves. Financial Reserves are increased through the Cash Flow generated by operations, and depleted by the Investments carried out (e.g., in Exploration activities). The outflow Investments generates a balancing feedback loop affecting the capital at disposal (the higher the Investments, the lesser the Financial Reserves and, subsequently, new Investments) that over time will induce stagnation and equilibrium.

Looking for a longer feedback loop across this business system, the participants identified the following: (1) An increase in Investments, (2) increases Exploration, (3) increases Oil Resources, (4) increases Oil Extraction Process, (5) increases Oil + Gas Wells, (6) increases Oil extracted, (7) increases Oil + Gas to Ship, (8) increases Oil shipped, (9) increases Oil + Gas Refineries, (10) increases Sales of Oil on the Market, (11) increases Cash Flow, (12) increases Financial Reserves, which in turn will allow (13) increasing (new) Investments, thereby closing the feedback loop. This second loop is a positive (or reinforcing) one, that favours growth over time.

The same task was performed during the second workshop, thereby leading to the identification and discussion of feedback loops within the resource maps built by the participants. In detail, Fig. 5 portrays one of the feedback loops identified during the debriefing phase in workshop no. 2.

Similarly to what was already presented, this part of the map informed the discussion allowing to analyse how the investments

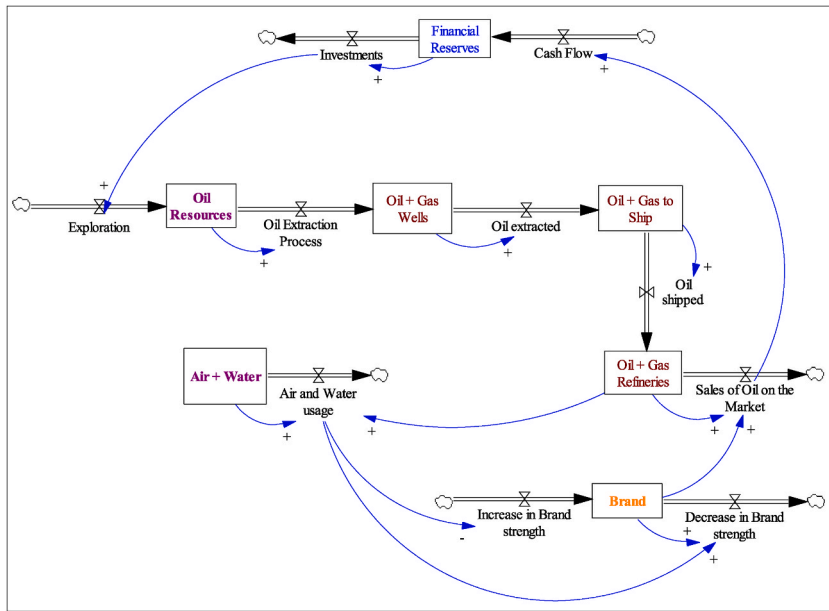


Fig. 4. The resource map with polarities and feedback loops (Workshop 1 - Group 1).

carried out by the company can generate a chain of impacts across the various areas of the organization’s business domain, eventually creating value in financial terms through increased revenues, as follows: (1) An increase in Investments (which initially drains the Financial Capital), (2) increases the number of new employees being hired (Hiring rate), (3) increases the Staff, (4) generates an Increase in service quality, (5) increases the Quality of Services offered, (6) increases the number of New passengers, and subsequently, (7) increases the stock of Passengers for this company, (8) increases the Revenues, (9) increases the Financial Capital at the organization’s disposal, thereby closing a positive (or reinforcing) feedback loop that will generate growth over time.

During the debriefing phase, the depicted resource maps were described by the participants, who were asked to explain individually the feedback loops and polarities reported in a specific section of the map. Each explanation was shared with the educators and the other participants of the workshop, to collect comments and/or suggestions on the work done, as well as to gauge individual learning. Moreover, in the debriefing phase, we collected the participants’ comments about the overall process of resource mapping in which they had been involved. These comments particularly emphasized the continuous interaction among the participants that was required by the process (“Actually, we had to agree about what to put on the paper”, participant - Group 2) and the participants’ engagement in analysing the integrated report by drafting a resource map (“I found interesting the fact that we were pushed to analyse the data with the ultimate shared goal of re-organizing them in a graphical form”, participant - Group 2).

7. Discussion

Primarily, the participants at the workshops developed their practical knowledge about the resource mapping technique, which was applied to the information selected from the integrated report. Coherently with a constructivist perspective (Papert & Harel, 1991), the resulting visual, i.e., the resource map, obtained from the practical application of the basic concepts of DRBV (Kunc &

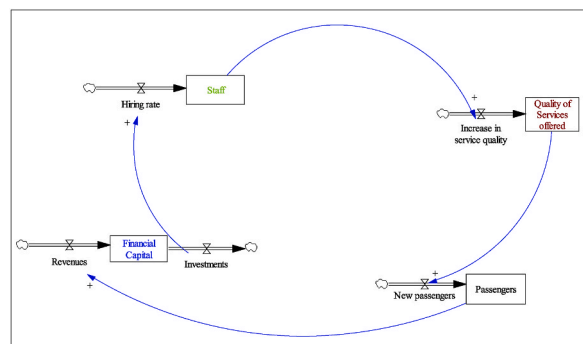


Fig. 5. Part of the resource map highlighting polarities and one positive feedback loop (Workshop 2 - Group 2).

Morecroft, 2010), had a twofold effect in terms of comprehension of integrated reports (e.g., Adams, 2017; Busco et al., 2021; Dumay et al., 2016). First, understanding the concept of feedback loop allowed the participants to deepen one of the main principles guiding the preparation of these reports, i.e., the principle of “connectivity” of information. Indeed, as feedback loops display the interdependencies existing among the components of the organization’s value creation process, the principle of connectivity states that an “integrated report should show a holistic picture of the combination, interrelatedness and dependencies between the factors that affect the organization’s ability to create value over time” (IIRC, 2013a, p. 16). Second, transforming the data and information selected from the integrated report into this visual helped the participants to organize the different pieces of the multi-dimensional information provided by the report in an integrated, “holistic” representation of a complex reality (Mento et al., 1999, p. 391). In brief, by drawing the resource map, the participants had the opportunity of understanding the principles of connectivity and integrated thinking initially dispersed in the data and information of the integrated report under investigation, and consequently, the managerial issues associated with the IR process (Dumay et al., 2016). Resource maps consequently acted as add-on tools that operated jointly with integrated reports (Barnabè et al., 2019) to build a concise, comprehensive, and informative visual of the various kinds of data and the narrative knowledge originally included in the reports.

As an example of these insights, we recall the results presented in Fig. 5. This figure shows a feedback loop obtained during Workshop 2 applying resource mapping principles and concepts. The information summarized in this map was originally dispersed (mainly as narratives) over the integrated report under analysis, with the participants being able to go through the whole process we asked for, identify relevant information, connect concepts across the report, and summarize them through the “language” of resource mapping in one visual. Notably, the part of the resource map shown in Fig. 5 highlights that the participants were also able to identify how value creation was *circularly* generated by this organization (i.e., exploiting the effect of a feedback loop) by using four different categories of stocks (Financial capital, Staff, Quality of services, Passengers) and activating specific key business actions (e.g., making investments and hiring new employees) that create trade-offs among such resources (e.g., investments decrease the stock of Financial Capital but build the stock of Staff).

Second, looking at the causal linkages and feedback loops represented in the resource map, the facilitators stimulated the participants to search for additional information about the dynamic dimension of the organization’s value creation process, thereby helping the participants to learn how to transform the “static information” of the report “into active knowledge” as in the stated potential of visuals (Hyerle, 2009). In this regard, it is also possible to convey the concept of capabilities to the learners, starting from the information and the descriptions included in the report. As an example, consider the results of Workshop 1, summarized in Fig. 3. This resource map allowed to represent the complexity of the domain under analysis (i.e., a company in the Oil & gas industry) and discuss with the participants where leverage points for value creation were identifiable in the system, and which processes were activated by the company to build other resources and generate value by attracting customers or influencing external stakeholders.

According to Ausubel’s view (Ausubel, 1960), these results mean that the abstract ideas of resource maps represented the concepts with a higher level of generality and inclusiveness that the participants adopted to reorganize the information from the integrated report into an orderly visual tool. This tool functioned as an “advance organizer” by providing “ideational scaffolding for the stable incorporation and retention” of the information collected from the report into the cognitive structures of the participants (Ausubel, 2012, p. 149). Specifically, since the use of this particular visual relied on the initially explained similarities between the integrated reporting and the resource mapping concepts, resource maps acted as a “comparative” organizer, thereby favouring the anchoring integration of the new materials (i.e., from the integrated reports) to the previously attained concepts by participants (Ausubel, 2012).

However, our findings also provide additional insights in terms of the teaching process of integrated reporting. First, by asking the participants to prepare a resource map, the educators stimulated the development of a “creative environment” (Marriott & McGuigan, 2018; McGuigan & Kern, 2015) where the participants had to adopt the orderly scheme provided by resource mapping “to draw” the holistic representation of the value creation process provided by the integrated report under analysis (IIRC, 2013a). The comments collected by the participants confirmed their great engagement in this creative process that required them to go beyond accounting numbers (Hines, 1988) and sometimes lengthy narratives about the organizations’ value creation processes (Tufte, 2001) to re-organize the fragments of texts extracted by the report in the platform provided by the resource map (Mayer, 1979). These comments particularly confirmed that the effectiveness of this visual as a teaching aid was particularly enhanced by the involvement of participants in the direct creation of their resource map, coherently with the previous literature emphasizing this aspect for the use of other visuals in accounting education (Schwartz, 2020; Simon, 2007). Notably, the differences that emerged between the resource maps drafted by the two groups of each workshop confirmed how the creative process was affected by the differences in the “existing cognitive structure” of the participants (Ausubel, 1963, p. 217).

Additionally, it is noteworthy to remind that the resource map (i.e., the visual representation) obtained from the integrated report required the interaction among knowledgeable and skilled people in the context under analysis, which was allowed by the group workshop format. This format facilitated alignment and teamwork (Valcourt et al., 2020), even if the participants’ starting level of education related to accounting reports was quite different. Indeed, even if the participants shared basic knowledge and expertise about the fundamentals of accounting, their different backgrounds provided conditions for fruitful interaction and discussion in class and during the mapping process (Mortensen et al., 2012). Under these conditions, the participants of each group had to deepen the information disclosed in the integrated report to find an agreement for all the decisions taken in drawing the resource map, which represented “the product of an active, integrative, interactional process” (Ausubel, 2012, ix).

Overall, these results confirm the potential of visuals in supporting the learning of integrated reports by facing their limited readability and complexity (e.g., Du Toit, 2017; Stone & Lodhia, 2019). Particularly, the connection and synthesis of a number of linear and one-dimensional narratives into the concise visualization provided by the resource map allowed to incorporate density of information and multi-dimensionality (Tufte, 2001). Moreover, even if supported by group interaction, the learning process developed

by using this visual affected the individual sphere of participants, who were able to demonstrate the effective anchoring of the new concepts deriving from the integrated report to their own cognitive structure (Ausubel, 1960 and, 2012).

8. Conclusions

We can state that the adoption of visuals, such as resource maps, when teaching integrated reports may facilitate the learning process of students by:

- 1) developing the understanding of the main principles underlying the preparation of integrated reports (i.e., the principles of connectivity and integrated thinking), therefore supporting knowledge acquisition about integrated reporting;
- 2) providing an orderly scheme acting as an “advance organizer” to represent the number of narratives extracted by integrated reports in a concise and comprehensive multi-dimensional visualization of the value creation process of organizations;
- 3) supporting the analysis of the dynamic dimension of this visualization to understand the future evolution of the organization’s capacity of creating value, as in the aim of the IR framework;
- 4) enhancing students’ ability to analyse and reorganize pieces of information and data originally dispersed across accounting-based documents using to this aim a methodology based on detailed practical steps and tools.

To summarize, this study contributes to the debate about the use of visuals in the accounting field (e.g., Davison, 2015; Quattrone, 2017), and specifically in accounting education (e.g., Osgerby et al., 2018; Simon, 2007). In this context, we believe that our results highlight the potential of visuals in supporting students’ learning when analysing integrated reports and their multi-dimensional information, as advocated by previous research (e.g., Velte & Stawinoga, 2017). Particularly, the support provided by resources maps to understand the connectivity among business elements in a causal and dynamic perspective as embedded in integrated reports is essential to educate students to be able of relying on this information to evaluate the trade-offs and consequences of organizations’ decisions (Caglio et al., 2020). Moreover, this study provides the methodological steps which are necessary to assist not only the learners but also the educators involved in such a process in effectively using visuals in practice for an increased understanding of the business reality under investigation (e.g., Davison & Warren, 2009; Gauntlett & Holzwarth, 2006).

9. Limitations and further research

This study is not without some limitations which, however, can stimulate future research. First, the study is based on two workshops with the participation of professionals and Ph.D. students. Additional workshops can be subsequently organized with different categories of learners (e.g., bachelor students – Montmarquette et al., 2004 – or investment managers – Arjaliès & Bansal, 2018), thereby allowing for the evaluation and detection of similarities and differences in reasoning that could be also associated with the participants’ individual characteristics and cognitive structures (e.g., Iskandar & Iselin, 1999).

Second, this study focused on two different business industries (i.e., oil and gas, and airline industries), being inspired by the basics of the multiple case-study analysis (Eisenhardt, 1989). On the one side, the selection of multiple cross-industry settings allows comparisons and is useful for exploratory analysis where similarities may support the creation of a generalizable theory. On the other side, this choice usually leads to a lower degree of detail and description if compared to the single case study approach. Thus, future research can use one type of business across different types of students.

Third, the potential of visuals in accounting education is explored in this study with reference to integrated reports and a specific visual (i.e., the resource map). In this regard, the authors intend to provide a more in-depth analysis of this topic and to expand the discussion to other visuals, such as causal maps and/or strategy maps.

Declarations of interest

None.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRedit authors

Although this article is the result of a joint collaboration, 1) Maria Cleofe Giorgino can be considered the main author of sections 2., 3., and 7. 2) Federico Barnabè can be considered the main author of sections 4.1, 6. 3) Martin Kunc can be considered the main author of sections 4.2, and 5. Sections 1., 8., and 9. can be attributed jointly to all the authors.

Data availability

No data was used for the research described in the article.

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