



Effectiveness of a child-friendly astronomy news platform for science learning – An exploratory study

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Abstract

Science education policies have promoted the role of science literacy practices, including reading, writing and reasoning with science texts, to advance inquiry-based learning in science education. Learning science through news is a promising approach. Since news provides meaningful real-life context, it stimulates the process of active questioning and learning science while fosters science literacy practices. Previous studies have reported that news improves science learning. However, they also reported some barriers to implement news as a teaching resource. The Space Scoop website is an innovative resource as it is specially designed to bring the latest astronomy news to young readers in the form of short, easy-to-understand stories. In this study, we conducted structured interviews in order to understand opinions of teachers and educators (N = 20) about Space Scoop as a teaching resource. This research also investigated the advantages and disadvantages of Space Scoop as compared to general news resources for science learning. Tests were conducted on Space Scoop articles to measure the readability of the articles. Our findings showed that Space Scoop is suitable for young children and motivates them to study science. Space Scoop has overcome the main barriers to teaching with news, namely, the advanced reading level and unreliability of information. Evidence from this exploratory study indicates that Space Scoop supports inquiry-based learning, improves science literacy skills and promotes lifelong learning. An in-depth study with expanded sample in the future would provide further evidence and understanding of how science news like Space Scoop supports science education.

Keywords: Astronomy, Science literacy, Scientific inquiry, Learning science with news

Introduction

Science learning via a hands-on, inquiry-based approach is well established as an effective way of gaining scientific knowledge (National Science Teachers Association, 2004). In contrast, learning science through texts has often been rejected because of the concern that students learn only facts rather than actually 'doing science' (Digisi & Willett, 1995; Yore, 1991). A typical problem with science texts is that they are complex and uninteresting. Hence, students depend on teachers for understanding science and this undermines learning (Pearson et al., 2010). Educators and policy makers have therefore emphasized hands-on, inquiry-based scientific learning over learning through texts (Digisi & Willett, 1995; Pearson et al., 2010; Rocard et al., 2007).

Nevertheless, science is not all about practical experiments: scientists do also need to read about previous investigations in order to frame new research, and reading and writing are indispensable means for scientists to inquire about scientific phenomena (Pearson et al., 2010). In this sense, writing, reading and reasoning with science texts, which are fundamental science literacy practices, are part of the scientific inquiry process and are essential for students to understand core science concepts and their development (Krajcik & Sutherland, 2010). Therefore, science education should take care to ensure that students can understand a science phenomenon through reading and can construct and

communicate explanations or argumentation for their ideas (by speaking or in writing) on the basis of existing literature (Hand, Wallace, & Yang, 2004; Moje, 2007; Sullivan & J, 2001).

When science literacy practices are embedded in scientific inquiry process, students learn simultaneously how to do science and how to read and write science texts (Pearson et al., 2010). From this viewpoint, science educators have shown considerable interest in learning science through news (McClune & Jarman, 2012; Millar & Osborne, 1998; Ryder, 2001; Yore, Bisanz, & Hand, 2003). Because news provides real-life context, reading becomes part of scientific inquiry as students try to find answers to a question meaningful to them or related to their lives. The need to know drives students to explore and reason with apparently difficult texts as well as conduct hands-on investigations to experience the phenomenon (Krajcik & Sutherland, 2010).

Two previous studies have investigated the use of newspapers in secondary schools in Northern Ireland, UK, and Alberta, Canada (Jarman & McClune, 2002; Kachan, Guilbert, & Bisanz, 2006). In both studies, the most common purpose of newspaper use among the schools was to link school science to everyday life and to highlight the relevance of school science, thus stimulating students' interest in learning and reinforcing the curriculum. The findings of these studies confirm that science literacy practices can be embedded in scientific inquiry when students learn through questions that are relatable or meaningful to them (Krajcik & Sutherland, 2010).

Additionally, in the two studies, students were reported to make references to examples in science news following initial contact with this news in the classroom (Jarman & McClune, 2002; Kachan, Guilbert, & Bisanz, 2006). Some students even relayed news from media reports and initiated a class discussion. Thus, these studies confirmed a predisposition for lifelong science learning through learning with news.

Learning with science news could prepare students to understand and have a critical eye about science in the media, whereby they can participate in social discussions about science or science-related issues that they encounter in daily life (Jarman & McClune, 2002; McClune & Jarman, 2012; Yore et al., 2003). Importantly, science in the media could reflect an important aspect of the nature of science, that is, 'science-in-the-making', besides reflecting the 'core science' aspect that has become an essential part of school curricula (Millar, 1997; Shapin, 1992). Science in the making is tentative and is continuously challenged and refined before becoming core science. Thus, science in the media familiarizes students with the central processes in scientific investigation (inquiry), including disputation and argumentation.

Given the increasing recognition of the benefits of news in supporting science education, the current study further investigated the effectiveness of an innovative source of news, the Space Scoop website (www.spacescoop.com). Space Scoop is a platform that collects the latest space news from astronomical organizations worldwide and edits the news into short stories written in a language suitable for children aged 8–10 years. These passages are translated into 31 languages. Children can access the Space Scoop website to read the articles, or teachers can download, print and put them up on classroom boards.

The primary goals of Space Scoop are to serve as source material whereby students can explore the Universe, spark interest in science and technology and help students appreciate new, exciting scientific discoveries. The news subject in Space Scoop is astronomy because astronomical achievements have always received considerable attention from the general public, and astronomy is one of the most interesting topics for STEM (Science-Technology-Engineering-Math) learning (Jidesjö, 2008; Jidesjö, Oscarsson, Karlsson, & Strömdahl, 2012; Oscarsson, Jidesjö, Karlsson, & Strömdahl, 2009; Percy, 2006). Moreover, astronomy effectively enables understanding of a range of scientific

concepts and can be linked to many curriculum topics. Some examples are geography (Earth, Moon, seasons, etc.), chemistry (atmospheric composition), biology (habitability), and mathematics (scales and proportions, navigation, etc.). It also illustrates many difficult, abstract concepts of physics well (Ampartzaki & Kalogiannakis, 2016; Percy, 2006; Tsourlidaki, Teodora, & Evita, 2016). Since Space Scoop employs a news format that is engaging for reading and learning and is based on a fascinating topic, it has great potential in promoting an interest in science learning and developing science literacy among students. Indeed, Space Scoop has even been incorporated in school textbooks (Reynolds, 2014; Universe Awareness, 2016). It would be useful to examine how innovative news platforms like Space Scoop support science learning, as this information could help educators understand how news could be best used for science education.

Although previous studies did confirm the benefits of using news for science learning, they also reported major barriers and disadvantages for teachers to incorporate science news in classrooms, like curriculum time constraints and the lack of suitable, ready-to-use resources (Jarman & McClune, 2002; Kachan et al., 2006). Another important challenge faced by many teachers is the inability to judge the accuracy of news reports. This concern is realistic, as media reports can be sensationalist, biased and contain errors under the subjective influence of news reporters, who aim to attract wider audiences (Singer, 1990). In addition, students, too, seem to be attracted by the sensational aspect of news, since the common topics chosen by teachers to attract students' interest included cosmology, Armageddon, the impact of meteorites, and odd stories like the ones about a mouse with an ear grown on its back or two-headed fish (Jarman & McClune, 2002; McClune & Jarman, 2012). Space Scoop could offer the best of both worlds, as the theme is an interesting topic to students (astronomy) while scientific accuracy is maintained, since Space Scoop articles are directly extracted from news updates from the best space agencies worldwide.

In the present study, we attempted to understand the common barriers to the use of science news in classrooms and thereby evaluated whether Space Scoop, as an innovative source of news, has overcome these barriers. By investigating the nature of Space Scoop usage in teaching and its effects on learning, we also verified whether the goals of Space Scoop have been reached. The main research questions and sub-questions of this study are as follows:

1. Is Space Scoop reaching the target audience?
 - a. Readability level of Space Scoop articles
 - b. Use in educational practice
2. How can Space Scoop assist in science learning?
 - a. How is Space Scoop used as a supporting teaching resource?
 - b. What effects does Space Scoop have on motivation and learning?
 - c. What are the advantages of Space Scoop over other sources of news used in classrooms?
 - d. What are some points of improvement for Space Scoop?

Methods

Readability tests for Space Scoop articles.

Readability indicates how easy and enjoyable a text is to read and how well it conveys the intended message to a reader (DuBay, 2004). Since a part of this research assessed whether Space Scoop articles are written at a level suitable for young readers (8–10 years old), we were interested to determine the readability of the original English articles and whether translation affected the reading level. To this end, 70 English articles were selected, that is, 10 random articles from each year between 2011 and 2017. Then, 70 corresponding articles translated into Dutch were analysed. These articles were scanned using the English and Dutch readability tests developed by WizeNoze (www.wizenoze.com/assess). This software also generated scores for the traditional readability tests,

that is, Flesch-Kincaid (for English) and Douma (for Dutch) (Owu-Ewie, 2014; Steensel, Gelderen, Oostdam, & Trapman, 2009). The outcomes of these analyses were subsequently compared to those of the WizeNoze score-based model. Table 1 shows the scores generated by the different readability tests.

Table 1. Interpretations of readability test scores

WizeNoze (English and Dutch)		Flesch-Kincaid (English)	Douma (Dutch)	
Score	Education level (American)	Interpretation*	Score	Interpretation**
1	Kindergarten-Grade 1 (age 4–6 years)	The score presents a US grade level and indicates	100–90	Very easy
2	Grade 2–3 (age 7–8 years)	the number of years of	90–80	Easy
3	Grade 4–5 (age 9–10 years)	formal education	80–70	Fairly easy
4	Grade 6–8 (age 11–13 years)	generally required to	70–60	Standard
5	Grade 9–12 (age 14–17 years)	understand a text; e.g. a score of 9.3 means that the text is readable by a ninth grader with English as the native language.	60–50 50–30 30–0	Fairly difficult Difficult Very difficult

*: (Owu-Ewie, 2014), **: (Steensel et al., 2009)

The WizeNoze tests generate results based on a 5-level scale for both English and Dutch; thus, the scores between the English and Dutch tests are comparable. Using the WizeNoze readability scores, we were able to verify these questions:

- 1) Is there a significant difference in reading levels between the original English articles and the Dutch translated articles?
- 2) Does a difficult term ratio, computed by WizeNoze and indicating the extent to which a document contains difficult words, influences reading level?

These questions were addressed by using a cumulative link mixed model. This model combines ordinal logistic regression and mixed effects models, to account for the ordinal nature of the WizeNoze scores and the pair-wise dependence of the translated articles, respectively.

Statistical analyses were conducted using the statistical software R, version 3.3.1 (R Core Team, 2016). The 'ordinal' package was used to construct the cumulative link mixed model (Christensen, 2015).

Structured interviews.

Participants - For this research, we collected opinions about Space Scoop from 20 participants from among teachers and educators who have used Space Scoop in education (formal and informal). The interviews were conducted with a random sample of Space Scoop users who responded to our interview requests. Interviews were possible with 10 teachers (from UK, Romania, Croatia, Belgium, Greece and India) and 10 educators (from Tanzania, Romania, Slovenia, Spain, Japan, Australia, Brazil, Ukraine and India). The participants provided comments, remarks and insights about Space Scoop versions translated into the language of their countries, except for a Belgian teacher who used English Space Scoop in an international school.

Data collection and analysis - Structured interviews that generally lasted 30–40 minutes per participant were conducted via online calls. The interview questions for evaluation of Space Scoop articles followed the generic learning outcome frameworks (Arts Council England, n.d.; Hooper-Greenhill, 2002; Kimble & Scorza, 2012).

Table 2. Framework for evaluation of Space Scoop

Feel	Value	Do	Understand	Skills
Interesting topic	School science is relevant to space science	Improve science learning and motivation for learning	Advantages and disadvantages of using science news and Space Scoop in classroom	Develop inquiry-based learning/teaching skill
Enjoy learning about space and general science	Link to previous knowledge and reinforce school science via real-life stories	Promote lifelong learning by reading science news	Purpose and method of use	Improve science literacy (reading and writing science text, discussion about science news)

Based on the evaluation framework (Table 2), two sets of questionnaires were designed for educators and teachers. Both the questionnaires could offer answers to several common questions regarding the use of news in teaching in general, and the strengths and weaknesses of Space Scoop. The teachers' questionnaire contained additional specific questions aimed at understanding the teaching experience with Space Scoop and its effects on students' learning. Table 3 offers an overview on what answers the educators' and teachers' interview questions could provide. For the questions that were common for both educators and teachers, the answers from all of the interviewees (N = 20) were combined for analysis to obtain general opinions about certain aspects of Space Scoop. The questions that were specific for teachers (e.g. how Space Scoop is used with students) were analysed separately; thus, the total number of interviewees for such questions was N = 10. To certain questions about Space Scoop, an interviewee could provide more than one opinion; therefore, the number of responses did not always tally with the number of interviewees asked that question.

Table 3. Interview topics for educators and teachers

Question topics	Educators (N = 10)	Teachers (N = 10)	No. of interviewees
Opinion about suitability of teaching with news for young children		X	10
Comparing the use of general news sources with Space Scoop in teaching	X	X	20
Space Scoop suitability for children aged 8–10 years	X	X	20
Nature of classroom practice			
Age of students		X	10
Space Scoop curriculum relevance		X	10
How Space Scoop supports learning (advantages of Space Scoop that create positive effects)	X	X	20
Effects of Space Scoop on motivation and learning		X	10
Space Scoop and lifelong learning	X	X	20
Disadvantages of Space Scoop	X	X	20

Results and discussion

Is Space Scoop reaching its target audience?

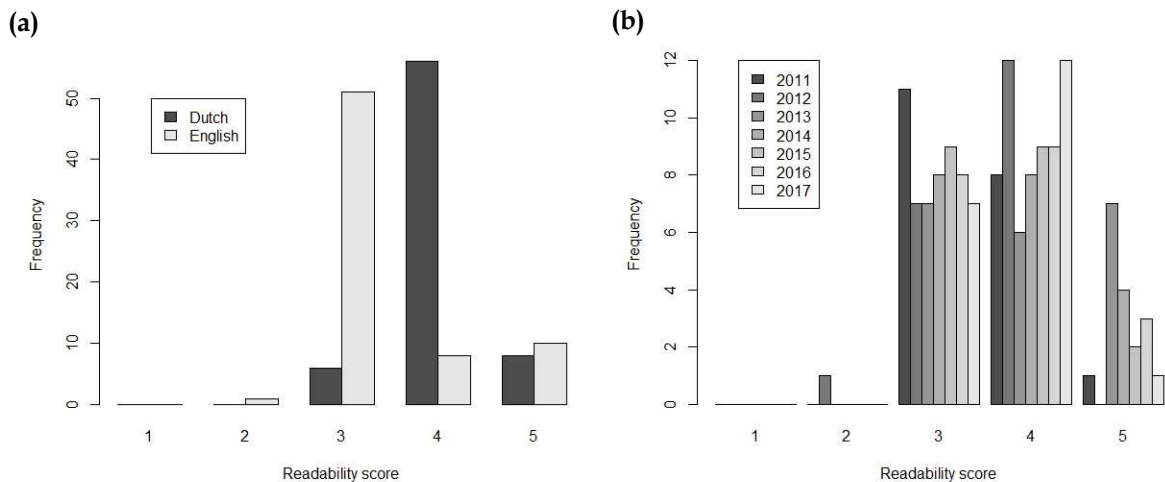
To evaluate whether Space Scoop is reaching its target audience (children aged 8–10 years), we combined the results from the readability tests of the Space Scoop articles with the responses of teachers and educators from the interviews. The traditional readability formulae, including the

Flesch-Kincaid and Douma tests, miss the complex textual features including reader’s vocabulary, age-appropriate grammatical structures, sufficient connectives to explain the flow of a text and the complexity of concepts (Harrison & Bakker, 1998; Janan & Idris, 2012). The readability test recently developed by WizeNoze considers these features. The WizeNoze test applies the natural language processing and machine learning predictive approaches, which are reportedly superior to the traditional readability tests (Feng, Huenerfauth, & Jansche, 2010; Franc & Miltsakaki, 2012; Heilman, Collins-Thompson, & Eskenazi, 2008). Indeed, we observed a clear difference in the outcomes between the traditional tests and WizeNoze.

The average reading level of English articles, as computed using the Flesch-Kincaid test, was 9.56 (Table 4), indicative of a reading level for a person with ninth grade education level (American system, age 14 years). The average readability score of Dutch articles, as computed using the Douma test, was 62.2 (Table 4), indicating a standard reading level for an adolescent aged 13–14 years (DuBay, 2004; Hensel, 2014; Steensel et al., 2009). In contrast, the WizeNoze test reported lower reading levels for both the English and Dutch Space Scoop. The most frequent scores for English articles were 3, indicative of a reading level of a 9–10 year old, whereas the Dutch translated articles mostly scored a 4, indicating a reading level of an 11–13 year old. Therefore, with the advanced readability algorithms, English Space Scoops appeared to have successfully reached the right reading level for their target audience, while Dutch Space Scoops appeared to be at a higher reading level (cumulative link mixed model, $p < 0.001$) (Figure 1).

Table 4. Flesch-Kincaid and Douma test outcomes

Year	Flesch-Kincaid (English)			Douma (Dutch)		
	Mean	SD	N	Mean	SD	N
2011	10.08	1.021	10	63.22	6.905	10
2012	9.802	1.254	10	61.29	7.946	10
2013	9.126	0.8678	10	63.64	5.449	10
2014	10.22	0.7715	10	61.54	5.599	10
2015	9.046	0.9079	10	61.56	7.692	10
2016	8.878	1.044	10	63.67	4.066	10
2017	9.769	0.9962	10	60.50	8.094	10
	x = 9.56			x = 62.2		



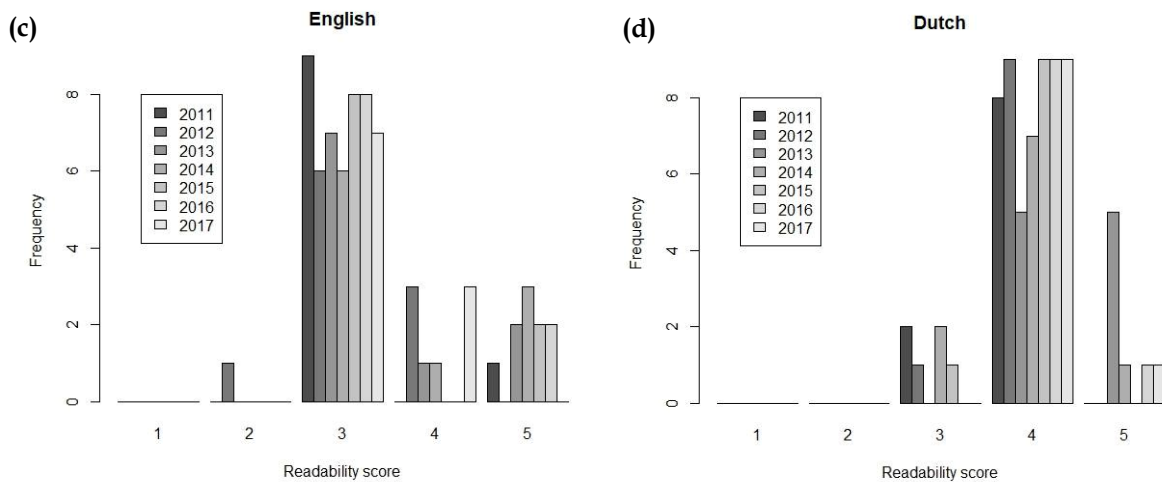


Figure 1. Reading levels of English and Dutch Space Scoop (WizeNoze tests)

(a): Dutch articles scored significantly higher than the English articles did (cumulative link mixed model, $p < 0.001$). (b): Reading levels were not found to differ significantly between years of publishing (cumulative link mixed model, $p > 0.05$). This was true for both English and Dutch articles (cumulative link mixed model, $p > 0.05$) (c, d).

It is important to understand that readability algorithms, even the modern WizeNoze, do not fully reflect how a text is actually perceived in practice. Statistical analysis showed that the computed WizeNoze reading levels were influenced by the difficult term ratio (cumulative link mixed model, $p < 0.01$), and several factors determine whether a term is actually seen as difficult in real life. Interest is one factor, as those interested in a topic, like astronomy, would be familiar with many related words. Readability tests do not account for this factor since the parameters must be set based on the general population, that is, words an 8-year old generally knows. The second factor unaccounted for in readability tests is the setting in which a text is read. In this particular case, Space Scoop provides a Space Words glossary site to aid the general population in reading and understanding unfamiliar astronomical terms, which are perceived as difficult in the readability algorithms. Moreover, the writing style of Space Scoop is not impersonal; it tries to connect with the readers by referring to something related to current trends, which might not be considered by algorithms of Wizenoze as commonly known terms. Besides, writers sometimes create new words that can visually express difficult concepts in the reader's mind, but the algorithms identify these words as unfamiliar to a reading level. For instance, 'spaghettification' might be identified as difficult, but it effectively illustrates the effect of extreme gravity that causes a person falling in a black hole to be stretched out, like a piece of spaghetti. Because there are more factors than simply textual features that determine the readability of a text, the results of readability tests cannot be considered definitive indicators of Space Scoop's suitability for children. To achieve a clear understanding of how well Space Scoop reaches its target audience, it is best to combine the computational readability analysis with actual feedback from the users of Space Scoop.

From the interviews, many participants agreed that Space Scoops are at the reading level of children aged 8–10 years, but there were some differences in the interviewees' opinions (Figure 2). Several interviewees ($N = 7$), including all 4 English Space Scoop users, stated that children at this age could easily read and understand Space Scoop on their own, while others thought they need some guidance from adults ($N = 5$). According to a few interviewees ($N = 7$), Space Scoop is more suited for older children, and the age considered most suitable for using Space Scoop also varied among interviewees. An educator from Slovenia explained that the problem was not difficult scientific concepts or astronomy words but that the reading habit and skill among children in Slovenia is relatively low at the age of 12 years, so Space Scoop is not suitable for younger children as they do not have an

adequately large vocabulary. Another educator reported that in Tanzania, there is little awareness about astronomy and only students at higher education levels (age 15–16 years) start becoming familiar with astronomical concepts. Therefore, differences in social, cultural and educational backgrounds among countries could cause a discrepancy in the extent of astronomy knowledge that children from different countries might have at a certain age. Consequently, the age suitability of Space Scoop varies.

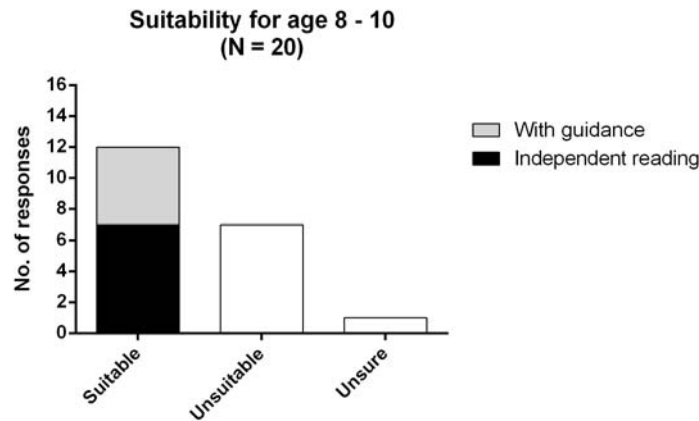


Figure 2. Suitability of Space Scoop content

All interviewees (N = 20), including teachers and educators, gave their opinions. Most interviewees agreed that Space Scoop was suitable for children aged 8–10 years, although a few thought it was more suited for older students.

Translation could be another factor that influences the readability of Space Scoop. Two participants who used an Indian version of Space Scoop reported it to be more difficult than the English version. Although no Dutch individuals were interviewed, the readability tests indicated that the Dutch Space Scoop was at a higher reading level than its English counterpart.

Two interviewees stated that the inevitable presence of astronomy terms and concepts in Space Scoop may have caused reading difficulty for young children who were unfamiliar with the topic of astronomy. While jargon is widely agreed to be taboo in texts that are intended for the general public, especially children, its presence increases the scientific index of a text (Fonseca, Russo, Barrosa, & Christensen, 2010), which could be beneficial in developing children’s scientific vocabulary and science literacy. If science education aims to inspire children to become scientists or to ensure they stay informed about scientific progress, which would be useful when they are making decisions in their personal and social lives, it is important for them to be able to understand scientific texts. Thus, reasonable use of technical words could expand children’s knowledge of science, improve their language skills and provide them modes of thought that are essential for them to move up along the science literacy ladder (Adams, 2011).

Although astronomy terms and topics can be overwhelming to children who do not have interest or previous knowledge, some interviewees thought that exposing them to such topics would still be beneficial because the children would start asking questions and having discussions, which help them learn even better. For one teacher, the astronomy terms and concepts used in Space Scoop were exploited as a tool for inquiry-based learning. This teacher commented that her students had so many questions, as they wanted to understand exactly what they had read. She then guided the students to the Space Words site that accompanies Space Scoop and provided them different informational platforms, such as ESA (www.esa.int/ESA) and NASA (www.nasa.gov), whereby the students could work on their own to better understand unfamiliar words or concepts.

Through our readability analysis and the interviews, we concluded that the original English Space Scoop was at the right reading level for children aged 8–10 years. However, translation appeared to affect readability. Because this study interviewed educators and teachers from different countries, we could see how well Space Scoop reaches audiences from different backgrounds, on an international level. Due to the limited sample, it would be useful to expand the scale of the study to include more teachers and students who are Space Scoop users in order to accurately determine the reading level of Space Scoop. Nonetheless, most educators and teachers in the present study have indicated Space Scoop to be well suited and an attractive learning material for young readers.

How is news best used in science education?

In previous studies, the prevailing view among teachers was that news was considered more suitable and useful for able and older students than for young children (Jarman & McClune, 2002; Kachan et al., 2006; McClune & Jarman, 2012; Reid & Norris, 2015). Studies focusing on media use in primary schools are scarce, and the current study provides useful information about teaching with news at this level since most interviewed teachers were working with primary school-aged students. Few teachers (N = 3) agreed with the previously reported opinion (Table 5). This discrepancy in views could be due to the advances in technology and lifestyle: children are exposed to the media sooner than they used to be. Indeed, the interviewed teachers agreed that children are already very aware of what is happening in the world and adults would sometimes be amazed at how much they know.

Table 5. Teachers provided opinions about a prevailing view that ‘Teaching with news is more suitable for older and able students’.

No. of interviewees (N = 10)	No. of responses
<i>Disagree (N = 5)</i>	
Young children are already aware of what is going on in the world around them	3
Children need to become critical of social media and news	2
More flexible, free time in the curriculum of young children	1
Familiarize students early to the wider world and science	1
Understand the fluid nature of science	1
<i>Neutral/Partly agree (N = 2)</i>	
Young children need simplified news	2
<i>Agree (N = 3)</i>	
Younger students are not able to evaluate and select trustworthy news	1
Young children have a short attention span	1
Ambiguous reasons	1

Thus, most teachers have frequently used news as a supporting teaching material, although sometimes they experienced difficulties in finding age-suitable news (N = 6) and the news needed to be simplified to ensure students’ understanding, which was time consuming (Figure 3a). Another barrier to using general news resources mentioned by several teachers was the inaccuracy of information (N = 4), similar to previous studies (Jarman & McClune, 2002; Kachan et al., 2006). Educators and teachers agreed that Space Scoop was far better than general news sources because it speaks at the right level to younger readers (N = 18), and the scientific information it provides is highly trustworthy (N = 11) (Figure 3b). The credibility of Space Scoop among teachers was evident from their responses: ‘I trust the news as it is written for students and used in many countries’. ‘... it [Space Scoop] has impartiality and education at its heart’. ‘Sometimes I see the same news as I read from Space Scoop’. ‘... because the news comes from space agencies around the world’. Therefore, Space Scoop serves as an example of the appropriate way to introduce science news to pupils of primary school age.

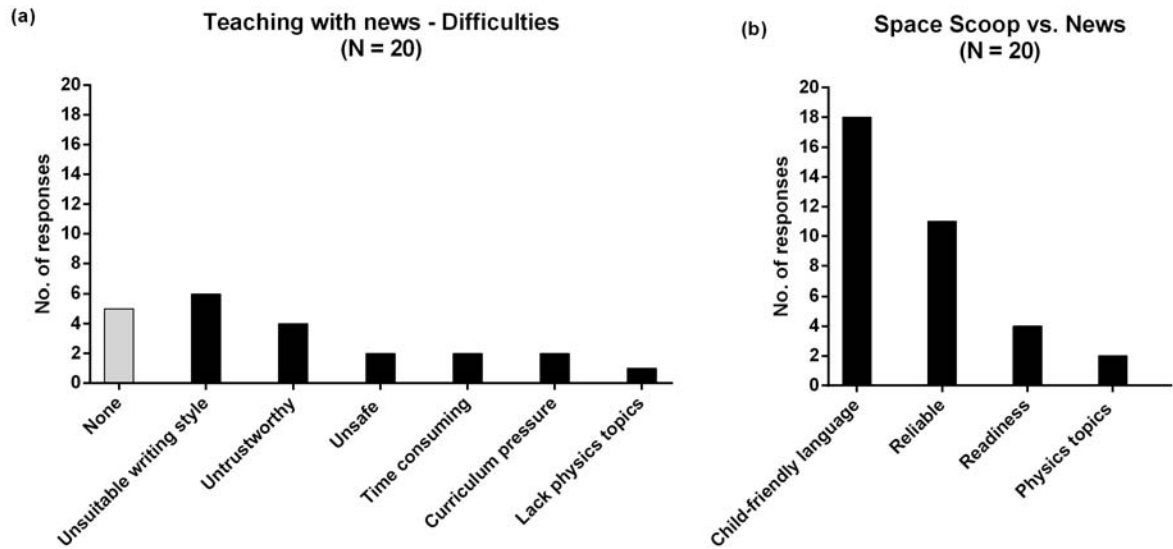


Figure 3. Features that make Space Scoop a better teaching resource than other news sources

All interviewees (N = 20), including teachers and educators, gave their opinions. One interviewee could give more than one opinion. Space Scoop was said to be a better resource as it has features that overcome the difficulties associated with general news sources (language, reliability, readiness, and lack of physics topics).

In the present study, teachers reported that they used Space Scoop in teaching for linking to a lesson as an example, or for explaining a concept. For instance, Space Scoop has been used by some teachers in Physics classes when there is a connection with the teaching topics e.g. gravity, light, velocity and magnetism. Additionally, Space Scoop stories were used in creative projects or activities that support a curricular subject. Teachers, from primary to high school levels, have reported various positive effects of Space Scoop on students’ learning and motivation (Table 6).

Table 6. Teachers reported the effects of Space Scoop on motivation and learning

No. of interviewees (N = 10)	No. of responses
Active discussion	10
Inspired to learn about space and general science	10
Improved learning environment in class (motivated)	9
Learn curricular science subjects better	8
Improved reading and writing ability (general and science text)	6
Perceive Space Scoop differently from a science text	6
Changed students’ attitude toward reading science texts, e.g. textbooks	5
Curious and ask more questions to learn	5
Attracted to science or space science careers	3

Students who learnt with Space Scoop were inspired to learn more about space and general science (N = 10). One teacher mentioned that his students had always had an interest in science in general but quite little interest in space science; however, since the implementation of Space Scoop, they showed much more interest in space science. Space Scoop positively influenced the learning environment in the class as students’ learning attitude and motivation improved substantially (N = 9). ‘They now look forward to the lessons’ – said some teachers. Regarding literacy practices, more than half the teachers

agreed that Space Scoop improved the reading and writing ability of students, for both general and science texts (N = 6). For one teacher, Space Scoop represented good writing and a resource for students to practice reading. Another teacher could link the tenses or descriptive adjectives used for describing events or planets in Space Scoop to what students have been taught in language classes. Two teachers stated that students were more confident while reading and discussing complex texts and scientific terms. Two other teachers mentioned that their students used Space Scoop vocabulary, knew more science words (also common vocabulary and phrases) and used them correctly in sentences. Having used Space Scoop, students were reported to react to this resource differently than when asked to read a science text (N = 6). 'Students liked Space Scoop more because it is funny, interesting and written in a fairy tale-like way'. 'Space Scoop is different because it is closer to their understanding compared to science text'. The pleasant experience when reading Space Scoop has changed students' attitude toward reading science texts, such as textbooks; they like to read more (N = 5). One teacher said – 'Before I started using Space Scoop, they did not like and did not understand science texts. Now they don't have these problems anymore'.

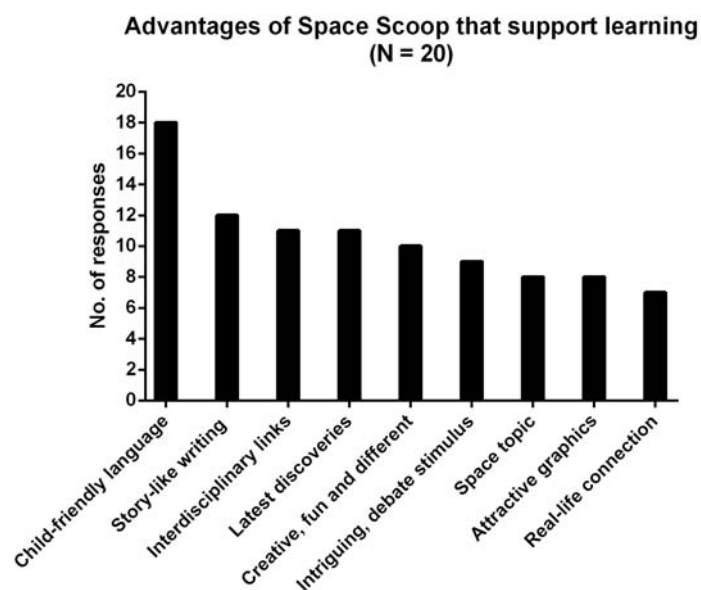


Figure 4. Interviewees explained the positive effects Space Scoop had on students. All interviewees (N = 20) gave opinions on the reasons for why Space Scoop improves students' learning and motivation. One interviewee could provide more than one opinion.

Teachers and educators attributed the positive effects of Space Scoop on learning and motivation to several important features (Figure 4). First, the science in Space Scoop is conveyed in a way that children are familiar with, using child-friendly language (N = 18) and story-like writing (N = 12). A narrative context is a more attractive medium to convey knowledge, since a previous study showed that the use of newspaper story problems positively influenced learning and motivation, more than traditional textbook problems did (Kuhn & Müller, 2014). Connecting scientific content with a narrative context like news generates a sense of familiarity among students, preventing science topics to be perceived as dry and irrelevant. The science in Space Scoop is also made relatable to familiar real-life experience (N = 7). The real-life context encourages students to actively engage in the process of making sense of the science texts. This process is characterized by the connection of new concepts to readers' prior knowledge or familiar experiences (Krajcik & Sutherland, 2010; Pearson et al., 2010). Thus, the associated background knowledge facilitates comprehension and motivates students learn something they consider meaningful (Broek, 2010; Krajcik & Sutherland, 2010). In this way, prior knowledge is also reinforced and possibly explains why teachers (N = 8, Table 6) have reported that students learnt curricular science subjects better.

Second, Space Scoop could support learning as it acts as a question and a discussion stimulus (N = 9) (Figure 4), since its astronomy theme engenders a sense of wonder, which is accompanied by curiosity (Hill & McGinnis, 2007; Schmitt, 2008). Questions and debates urge students to learn to find answers. Teachers (N = 5, Table 6) noticed that Space Scoop led students to be more curious; some tried to find answers from textbooks and reference books in order to understand what they had read in Space Scoop. As reported by all teachers (N = 10, Table 6), learning with Space Scoop has enhanced students participation in discussions, which could improve science literacy since the ability to discuss science is one feature of science literacy (Hand et al., 2004; Moje, 2007; Pearson et al., 2010; Sullivan & J, 2001).

A noteworthy effect of Space Scoop reported by a teacher was that the students who learnt with Space Scoop were enthusiastic to join their teacher in workshops to teach their younger peers about what they knew about space. A previous study stated, 'Children learn more from teaching other children' (Gartner, Kohler, & Riessmann, 1971). This peer teaching experience could improve students' communication skills and self-esteem; further, as they enjoy sharing knowledge, they could be motivated to learn further (Gaustad, 1993; Whitman, 1988). Previous studies have shown that talking is an effective way to improve existing knowledge and deepen understanding. This is achieved as peers share and clarify information by asking questions, constructing explanations, hypothesizing and formulating ideas (Dunlap & Grabinger, 2001; Glaser, 1991; Rivard & Straw, 2000). As Space Scoop was said to serve as intriguing opening point and stimulates discussion, it consolidates and reinforces students' prior knowledge; this explains why teachers (N = 8, Table 6) have reported that students also learnt curricular science subjects better.

The third positive feature of Space Scoop is that it could create an interest or further an existing interest among readers and act as a starting point for learning. Space Scoop is interesting in various ways: it has attractive graphic components (N = 8), it is fun and different from the traditional way of learning (N = 10) and shows up-to-date scientific discoveries (N = 11) (Figure 4). Importantly, Space Scoop was reported by both educators and teachers (N = 11) to have interdisciplinary links to many science subjects (physics, mathematics, chemistry, biology, geography) and non-science subjects (art, history, philosophy, language, domestic technology). For instance, a teacher said that she could link the Space Scoop story 'The Great Cosmic Bake-off' to mathematics, chemistry and domestic technology (cooking). The interdisciplinary links of Space Scoop make it a flexible educational resource, and readers always can relate to something that matches their interest.

Moreover, the fact that Space Scoop generates interest or relates to the readers' interest is crucial for capturing initial attention to start reading. As students read Space Scoop and realize there are new, interesting things to learn about science, a news reading habit can be formed. As shown in the present study, students have begun to read more news on their own and relate news to the class for discussion. The purpose of discussions is mostly to explore and further understand what they have read, to share knowledge with and express their interest to teachers and peers and sometimes to relate, support or disprove what they have read previously. These are proof that a lifelong learning habit that would help students become more science literate has been formed. Additionally, some teachers believe that Space Scoop forms a mind-set of lifelong learning because it is a medium that creates interest in science at an early age (Table 7).

Table 7. Space Scoop promotes a lifelong learning habit among students

No. of interviewees (N = 20)	No. of responses
Form a news reading habit	15
Referred to news or brought news in class for discussion (reported by teachers)	9

Read more Space Scoop in their free time (reported by teachers)	7
Science made interesting	6
Early science exposure	4
Realize there are new things to learn in science	1
Critical of traditional views	1

Collectively, these features of Space Scoop make it an effective news resource for embedding scientific literacy practices in scientific inquiry process. As Space Scoop fosters interest, curiosity and familiarity, students are stimulated to learn science through questions that are relatable or meaningful to them. And simultaneously, through reading and discussion, students learn science literacy skills. From this study, we could construct a model explaining the factors important for effective use of news to support inquiry-based learning and improve science literacy (Figure 5).

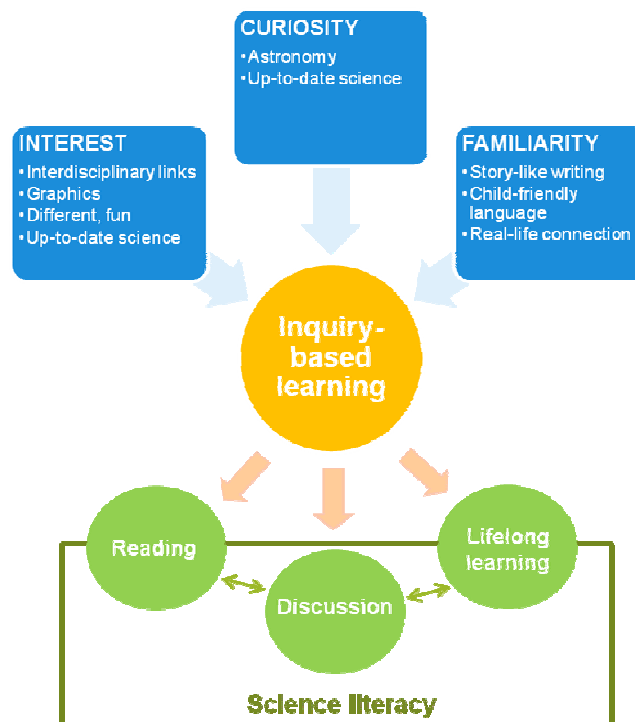


Figure 5. Model of effective learning with news

Space Scoop fosters interest, curiosity and familiarity during reading, thus stimulating inquiry-based learning. As a result, students are interested to read more Space Scoop articles and news for learning, engage in discussion and become used to learning science throughout their life. All of these effects promote science literacy.

Summary and future prospects.

The findings from this research indicate the usefulness of Space Scoop and provide insights into factors that could be important to use news effectively in teaching. However, this is only an exploratory study with a very limited sample. In the future, we will continue our research with a larger sample size and include a control group of students who do not use Space Scoop. Such a study would accurately reflect the effectiveness of Space Scoop as a learning resource and help us better understand the impact of news articles on science education.

This study confirmed that teachers highly appreciate Space Scoop and used it for teaching in various creative ways, even though the theme of Space Scoop is astronomy, which is not always a specific subject in the school curriculum. The most common intention ($N = 6$) for teachers to use Space Scoop

with their students was for the students to learn about space, which was prompted by the student's interest or the teacher's own passion for astronomy. Because Space Scoop usage was interest driven, it was never used only as a display resource that students might rarely notice but instead became an integral part of the lesson. Space Scoop was used mainly to provide examples or illustrations about concepts in lessons, and it made science more accessible, rather than something exclusive for only scientists to know and understand. In addition to the overwhelming advantages, interviewees also mentioned suggestions for improvement. Space Scoop could become more interactive to engage children better and to keep them returning for more. Further, accessibility of Space Scoop through the internet was reported to be advantageous, but for countries where internet access or usage is low (e.g. Tanzania, India), this is a limitation. Although Space Scoop articles are printable, some interviewees have recommended that Space Scoop be published in printed form as well. As reported by an educator, it seemed that teachers and parents preferred to have Space Scoop as a magazine rather than as sheets printed from PDF documents. A one-issue printed resource called Space Science News with articles supporting learning related to curricula was reported to overcome the disadvantages of news usage in class, similar to Space Scoop (Jarman & McClune, 2005). The core value of Space Scoop is to provide fresh scientific discoveries; thus a one-issue printed document like Space Science News would not be suitable. Perhaps, a bi-monthly or quarterly issue containing the latest Space Scoops would benefit areas where internet access is a problem. Some interviewees expressed the need for more translated versions of Space Scoop and for improving current translations for certain languages, such as Tamil. During interviews, some educators have volunteered to translate Space Scoop. This would strengthen the effectiveness of Space Scoop, as multilingualism is a well-appreciated feature.

The findings of this study indicate that the primary goals of Space Scoop have been achieved. Children aged 8–10 years, adolescents and even adults have found Space Scoop interesting and enjoyable. Space Scoop has inspired its readers about science and astronomy. One teacher who held workshops for colleagues about teaching astronomy said that 'Because of Space Scoop, we managed to interest the primary level teachers ... and even though they have not started to use Space Scoop, they have begun to teach astronomy to their students'. This exploratory study showed that Space Scoop has supported teachers in many ways and has improved students' learning and motivation.

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