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# Science Education under a Totalitarian Theocracy: Analyzing the ISIS Primary Curriculum

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**Abstract:** We conducted an unprecedented analysis of the Islamic State of Iraq and Syria (ISIS) primary school science curriculum. The research question focuses on the general scientific quality of the five documents examined, the integration of religious content and the possible tensions between science and religion that result from including such material in the corpus. This content analysis also focuses on the ideological/political agenda that supports its content and structure. Conclusions argue that the ISIS science curriculum appears to be committed to an absolutist/theocratic ideological program that, among other things, promotes a very inadequate concept of scientific activity and content. Recommendations about secularization and the reconstruction of post-ISIS education systems are formulated.

**Keywords**: *Curriculum; Science; Religion; ISIS.*

## Context

### Religion and Science Under Tension

The tension between science and religion is a very old and still unresolved debate. In the public sphere, the idea of "civilization" refers by definition to their separation. Such a principle has also sometimes been described as a "founding myth" of the Western "civilized" world (Carr & Thésée, 2009). This separation is also often considered the result of past conflicts, such as the one between Galileo and the Church (Boorstin, 1983). But instances in which science and religion overlap, meet or clash still arise, and the tension between them still exists, sometimes visible around certain sensitive topics such as evolution and determinism, or in certain parts of the world more than others.

The reasons for the rivalry between science and religion go beyond those that fuel ordinary antagonism between religions. While these might compete for the truth value of their respective sets of dogma, science chooses to reject dogma altogether. Bertrand Russel (1935, p. 194) explained that "a religious creed differs from a scientific theory in that it claims to express an eternal and absolutely certain truth, while science holds a provisional character [...]. Science, therefore, incites us to abandon the search for absolute truth and to substitute for it what may be called the 'technical' truth, which is distinctive of any theory that enables us to make inventions or to predict future events." Thus, paradoxically, the only doctrine that science embraces is the rejection of doctrine. In this view, even scientism has to be considered as an adversary of scientific thinking.

Therefore, for certain problems, questions or topics for which a religion claims truth and for which science can conduct its Popperian (1995) inquiry-based refutations, conflicts inevitably arise. In such cases, power equilibria can be displaced, and different outcomes can arise: amicable divorce, subordination, acknowledgements of compatibility (or complementarity), etc. However such (latter) attempts at reconciliation, mostly proposed by clergymen, have been seen to be sometimes inequitable. Thomas Aquinas, for example, has argued that truths that are accessible by reason or faith are not contradictory, and at the same time, that both provide access to religious beatitude (Torrel, 2015). Thus, under such circumstances, science is subjugated by, and serves,

faith. Other attempts have tried to establish fundamental distinctions between science and religion. For example, it has been proposed that science provides answers to "how" questions, while religion answers "why" questions (Pinker, 2018). However, the exclusive character of this dichotomy collapses when we see that the only "why" for which we can provide answers through reason are in fact "how" questions (*ibid*.). Thus, for Russel, a reconciliation appears to be out of reach: "Religion inevitably steps on science's toes when it formulates truth claims" (1935, p. 133). For him, when such conflicts arose, science always triumphed in the end, and thus made religion lose ground every time. God seems to disappear and rationally constructed explanations are eventually provided: thunder, the plague, the rainbow, Earth's age, etc. However, observations show that this is not always the case: in certain circumstances, religious explanations prevail, usually imposed by authority – but sometimes also by violence.

**School as an Arena**

One of the roles of public schooling is the reproduction of cultures. Through national and state curricula, public school provides an image of the ideal citizen's characteristics: what he/she should know, be, and be capable of. However, school time is limited and not all aspects of culture can be thoroughly investigated in this context. So, even when or if schools cultivate humanistic ambitions (such as the complete emancipation of persons), it is still inevitable that they be minimally normative. This normativity necessarily suggests exclusion; it implies that difficult choices about the content to be taught and learned have to be made. School cannot be what everybody would like it to be. It thus becomes an ideal arena in the battle for truth. Since school is mandatory for all, and because children are easily influenced and represent the future, it is not surprising that school curriculum is one place where science and religion most strongly collide. A lot is at stake.

Some authors argue that religion should simply be "kept away from public schools and universities," even if it is taught in separate courses (Mahner & Bunge, 1996, p. 101). The argument is that it is judged to be contrary – and thus detrimental – to scientific thinking. Diverging authors believe that incorporating religious considerations into the teaching of science could be allowed because it is "perfectly possible for a science teacher to be respectful of worldviews […] even if these are scientifically limited, while clearly and non-apologetically helping them to understand the scientific worldview" (Reiss, 2007, p. 98). Finally, other authors believe that talking about religion (or any non-science subject) in science courses could provide opportunities to better understand the nature of science itself by providing clearer counter-examples (Potvin & Charland, 2009). Nevertheless, the prevailing policy about religion in Western countries' science classes is somewhat of a "don't ask, don't tell" tradition.

However, some school systems allow, encourage or require that religious discourse be incorporated into the general curriculum – even in science programs and material. This is true throughout the world, including the West. For example, Brian Alters (2001) had already described the importance of the "evolution-creationism/intelligent design" debate that raged in more than 12 U.S. states. In one of the cases, "the Kansas State Board of Education voted to remove almost all mention of evolution from the state's education standards" (2001, p. 6). Coralie Delhaye also provided a good example of such a prescription in Greece, where the Orthodox Christian Church is politically very active, and where "the government does not encourage teachers to use all content found in textbooks, but forces them to" (Delhaye, 2014, p. 50).

Delhaye, however, argues that religious and scientific discourses are not in explicit conflict anymore, the way they were at the beginning of the 20th century. She gives many examples of contemptuous sentences taken from secondary school biology textbooks that were used until the 1950s, such as: "evolution does not hold water". She argues that, due to the implacable character of scientific progress and the growth of occidental secularization, science textbooks that contain religious views have abandoned their superior tone. And indeed, in her 2014 analysis of Greek textbooks, she noticed that the autonomy of science and religion was valued and that there was an expressed need for mutual non-rejection. In instances in which science and religion were explicitly related (in topics such as evolution), she recorded *concordist, complementary* and even *interrelatedness* concepts. However, within these types of reconciliation, she still saw (although less explicit) religion being overvalued at the expense of science (e.g., the only virtues expounded were those of the Orthodox faith, while the virtues of science were presented as conditional to a sense of justice or conscience). Delhaye also observed that religious discourse appeared to insist less on its intrinsic truth value and more on its ability to promote well-being.

The subordination of science through authority (whether democratic or not) can impact its prosperity in many ways. The strongest consequence is omission.

While not religious, the example of China is striking. In 1968, physics, biology, history and geography were simply eliminated from many schools "because administrators then felt that these were irrelevant to the needs of the economy" (Kwong, 1985). Another example is the removal of mentions of evolution (by means of natural selection) from the curricula of many U.S. states. We have also seen evolution being "always placed at the end" of early 20th century textbooks (Delhaye, 2014, p. 50).

Another consequence is compromises made about the meaning of certain important concepts. For example, in the discourses of creationists or religious apologists, the concept of *theory* (such as in the "theory of evolution") is often reduced to, and handled as, "hypothesis." Similarly, the concept of *evidence* is used as a synonym of *absolute proof* (or *mathematical* proof). Also, the pedagogical concept of *constructivism* is often reduced to one of *relativism* (Taşkın, 2014), etc. All these examples inevitably lead to a relative reduction of the certainty status of targeted scientific topics.

Finally, we also witness, under certain authoritarian regimes, an impoverishment of science itself and consequently of prescribed "scientific" activities in teaching. For example, in Saudi Arabia, "neither textbooks nor workbooks provide students with the opportunity or encouragement to develop their inquiry skills" (Aldahmash, Mansour, Alshamrani, & Almohi, 2016, p. 897). We also see deficiencies in references to the history of science, epistemological considerations, and to the processes by which scientific knowledge gains credibility (by comparing, for example, the respective predictive powers or rival scientific theories). In such contexts, scientific facts are often presented as a collection of dogmas and the development of critical thinking does not seem to be a priority, nor is it explicitly targeted. Thus, under political/ideological pressure, science usually seems to lose ground, as well as its fundamental and distinctive properties and meaning.

**Science Education in Muslim Countries and Settings**

Historically, science has not collided as violently with Islam as it has with Christianity. It is possible that the relatively peaceful science/Islam coexistence is the result of the many invitations to study nature that one can find in the Qur'an. It is also largely celebrated in the Muslim world, as well as in the rest of the world, that medieval Muslim civilization made many important contributions to science (Sabra, 1987). However, Islam also shows great doctrinal diversity and interpretations of the Qur'an and other sacred scriptures and stories vary from one country to another.

Such diversity can also be seen in political orientations. While some Muslim countries, such as Indonesia, have a rather clear democratic and tolerant tradition, others, such as Saudi Arabia, Afghanistan, Iran and Pakistan, are official Islamic States, and have more authoritarian governments. In such countries, Islam is even more clearly understood as having something to say about all spheres of life. According to Anila Asghar, "in many Muslim societies, [Islam] is essentially considered a complete code of life and therefore permeates almost every aspect of the culture" (Asghar, Hameed, & Farahani, 2014, p. 2). Secularization is often largely regarded as negative and understood as a rejection of God, and sometimes the word "civilized" is even used to denigrate.

Naturally such variability in Muslim countries is not without consequences on their respective educational systems and curricula. In an explorative study about the integration of the concept of *evolution* and related constructs into textbooks in five Muslim countries (Egypt, Malaysia, Syria, Turkey and Pakistan), Asghar found significant differences. While "human evolution is not mentioned explicitly in any of the curricula [she] examined, […] it is implied in the Egyptian and Pakistani textbooks while discussing lines of evidence supporting evolution" (Asghar et al., 2014, p. 9). She also noticed that only Pakistani textbooks explicitly attempted to reconcile science and the Qur'an by using "religion […] as a justification for the acceptance of the scientific theory of evolution" (*Ibid*. p. 11). For example, since holy texts say that Allah has created living things in water (The Qur'an, 21:0), this is presented in textbooks as acceptable evidence for the scientific hypothesis that proto-cells have developed/evolved in the ocean or in hot springs. Finally, Asghar noticed that the textbooks analyzed did not sufficiently address concepts and processes related to the nature of science.

Such observations were also made concerning Algerian textbooks, in which religious knowledge from the past is presented as explaining present knowledge. For Djilali El-Mestari (2011) who conducted this analysis, this "does not help the learner make a distinction between religion as faith and its [eventual] ideological *instrumentalization*" (p. 8).

In their harsh analysis of "science education in Arab States" in 2011, Zoubeida Dagher and Samoua Boujaoude regret that most science curricula in 11 Arab countries do not develop investigative and

critical thinking skills; ignore students' backgrounds, historical contexts, the nature of science (N.O.S) and possible everyday applications; and do not address myths and superstitions. Evaluation is essentially centred around rote learning, and there are many significant strategic omissions, especially in cases that "may pose potential conflict with religious beliefs" (Dagher & Boujaoude, 2011, p. 79).

As a result of the subordination of science to religion (sometimes presented as "compatibility"), and of shortcomings in in-service training, it is not surprising that Mansour reports that for many Egyptian science teachers, "religion comes first and science comes next" (2010, p. 127). Such commitments sometimes lead to resolutions that are clearly detrimental to science. In their analysis of teachers' positions regarding biological evolution, Muslim teachers often reject or reinterpret the scientific version by means of religious justifications. They even sometimes go as far as granting a role to humans or to God in the process (Boujaoude et al., 2011). Such commitments are not always exclusive to geographical settings since it has also been recorded for Muslim graduate students in science-related programs in a Midwestern U.S. university (Taşkın, 2014).

However, we do not believe Islam to be responsible *per se* for the rather bad shape of science education in many Muslim/Arab countries. The mere observation that significant differences in secularization and educational quality exist within the Muslim world suggests instead that it is plausible that the *exploitation* of Islam faith and doctrine for authoritarian political purposes may pose a greater threat to the development of critical/scientific thinking. We thus turn our attention to a case in which there is little doubt of the *instrumentalization* of Islam for authoritarian purposes.

**Science Education Under an Islamist Totalitarian Theocracy: ISIS**

The Islamic State of Iraq and Syria [or the Levant] (ISIS) is a terrorist Salafist jihadist organization that began its development in the 1980s (al-Tamimi, 2015) through the efforts of jihadist groups to conquer by force and govern territories of the region. It increased its influence in Iraq and Syria by violent means until 2014, when it declared the foundation of a Caliphate, and 2015, when it reached its prominence to the point of being identified as a proto-state, with most of an official state's characteristics, including a well-developed bureaucratic apparatus[1], but without international recognition. Since then, ISIS has progressively declined in influence and was chased out of Iraq on December 10, 2017. Today, apart from a small amount of land it lays claim to in Syria, ISIS is considered by many as essentially vanquished. It was nevertheless characterized by its high level of violence (beheadings, crucifixions, amputations, destruction of archeological treasures, etc.) and met all of Freidrich's (1956) list of properties for identifying totalitarian regimes (charismatic leader of a single party; strong and exclusive ideology; terror-based police; total control of economy and of means of mass communication). It is difficult to estimate how many people have been ruled under this regime, but some satellite-based estimates exceed five million (Berman and Shapiro, 2015).

Westerners are often surprised to learn that ISIS implemented a working education system, with schools, paid teachers, inspectors, and state curricula/textbooks that were prepared and printed by the official Islamic State Press [Maktabat Al-Himma] (Olidort, 2016). It is believed that this system was implemented for about a third of all the children living under ISIS (Stern & Berger, 2015). Among other things, this education system was characterized by the prohibition of gender mixing, and a focus on religion-based doctrine, with the memorization of The Qur'an being a key component. According to Arvisais and Guidère (2018a), more than half of school time was devoted to religious study, and even profane content had apologetic and Islam-praise functions. Among other pedagogical goals, textbooks also contained guerilla-based and hate-based objectives that aimed at preparing "child soldiers […], who will conduct effort 'until death or martyr' (*al-nasr aw al-shahâda*)" Arvisais and Guidère (2018a) against "disbelievers, polytheists and hypocrites," (*Ibid*.). Even the teaching of math and computer problem solving were largely contextualized in very violent settings (Olidort, 2016).

ISIS outlawed the teaching of certain subjects (music, drawing, sports, philosophy) (Olidort, 2016), and libraries were purged by fire of all non-Islamic books (Guidère, 2017). It is therefore rather surprising that it decided to maintain the teaching of science at primary levels (ages 6-10). It was, however, reserved for boys, while girls received training in child care and domestic duties. Like it is often the case in Eastern countries, the (state) curriculum, textbooks and workbooks were not separate entities; instead, they were assembled into a single set of documents, for universal use by teachers and students. The simplicity and unicity of this set of documents (hereafter designated as "the corpus") allows for a complete analysis of the intended curriculum. The general research question thus becomes: **what's left of science education under a totalitarian theocracy?**

We will attempt to provide answers by means of an analytic description. Of course, this analysis does not aim to describe the actual teaching that was dispensed (implemented curriculum) or the actual learning that resulted (achieved curriculum) (Valverde, Bianchi, Wolfe, & Houang, 2002). Indeed, we can presume that some teachers resisted (at least) parts of it or might not have understood exactly what was asked of them, and thus might not have taught in complete compliance. However, an analysis of the corpus can provide information that is crucial to the interpretation of ISIS' *intentions* vis-à-vis science education.

**A General Description of the Corpus**

The corpus was obtained through a local NGO by the leader of the *Sami*[2] project: (Author), a researcher active within the (Infractructure). All materials of the project were recovered in 2017 in the ruins of Kirkuk, in Northern Iraq, after the withdrawal of ISIS. The considered "science education primary subset" is composed of five documents[3], one for each school year, from grade 1 to grade 5, and entrusted to the EREST team[4] for analysis[5]. These documents are consistent with other sets of officially released documents that can be found in Muslim countries because they contain not only lists of axiological objectives, but also content (subject matter) of all types, as well as activities. Thus, unlike in Western countries, state programs, manuals and workbooks are merged into a single document for each discipline, for each school year.

These five documents were colour-printed on thick paper (industrial printing), contained many images and photos, leading one to believe that professional educators were involved in their design. Indeed, the entire corpus was intelligently organized into "themes", just as in many modern *integrated curricula* that already exist throughout the world: "Health and safety" (grade 1), "Water in our lives" (grade 2), "Earth, soil and agriculture", "Electricity in our lives" (grade 4), etc. These themes were divided into subtopics, and sometimes into lessons. Many of these themes were repeated in more than one level, with a gradual increase in complexity, suggesting a "spiral approach" (Gueudet, Pepin, & Trouche, 2016). However, important parts of these documents are surprisingly lean, and many pages do not contain a lot of information or images. However this can be expected because the students were very young.

All documents have introduction, objectives, content, and activities sections, not always exactly presented in the same order or with rigour. These documents all begin with an apologetic text about the general function of education under the ISIS realm. This text begins with:

> "Praise be to Allah, honouring the believers with His victory, lowering the unbelievers by His power, executing all action by His will, drawing the disbelievers by His judgment, the One who determined the alternation of days by His righteousness and who made the end happy to the pious by His grace, and peace and prayer (blessing) of Allah be upon him who has erected the lighthouse of Islam by his sword…"

And it ends[6] with praise to ISIS, which is essentially presented as being in opposition to vice and to the rest of the world (Eastern as well as Western). These introductory sections will not be analyzed further, since they are repetitive, and because their content and function can easily be understood and assessed with a simple reading.

The remainder of all five documents was translated from Arab into French for analysis by a professional and a translator with knowledge of the Qur'an and Islam. Figure 1 shows excerpts of three pages: on the left, an (apologetic) introduction from Grade 4 and two ordinary pages from Grade 1 (with [natural] scientific [animals], religious [prior children] and jihadist images [here, in page 53: a child soldier, bottom right]). We are aware that the Arabic word "jihad" can have many peaceful meanings, such as "effort" or "struggle" and that most do not refer to activism or aggressive ways. However, in this paper, we will reduce the concept of *jihadism* (and *jihadist*) to its activist (call for implementation of *sharia*) and/or belligerent connotation, which is the one that is widely and almost exclusively used by ISIS.

Such jihadist elements were present in our "science education subset" from time to time, but not as much as in the mathematics program, for example, where they were omnipresent. Still, we were interested by such belligerent elements in our analysis, but since they were relatively scarce and because our main focus is science education, we will focus primarily on scientific quality considerations.


*Figure 1*. A few pages excerpted from the corpus

## Methods for the Analysis

All documents were coded once, and then verified by a second analyst. All phrases and illustrations were considered as one (1) unit of analysis. When sentences were too complex and contained many ideas, they were fragmented into more than one unit. However, we tried to stick as much as possible to a "one sentence/one code" system. Thus, our selected codes were tentatively exclusive of one another. This coding system was developed by the research team, and pretested on a fraction (about 10%) of the corpus to check whether all the units could be coded. It was then validated, adjusted, and then applied to the entire corpus.

(A) Units that described pedagogical *objectives* (usually in the sections at the beginning of documents) were coded according to a simplified version of Bloom's taxonomy (1956) if they were scientific in nature. The following codes (Table 1) were attributed, many of them followed by a prototypical example of a unit, with reference provided between square brackets to grade level and page number. e.g.: [GX, p. x]Such jihadist elements.

Table 1.
*Pedagogical Objective Codes Used for Analysis*

| Code | Examples of acceptable units |
|---|---|
| 1) **Knowledge** objective | "The student must be able to: 1- list oviparous animals. 2- name reptiles." [G3, p. 70] |
| 2) **Comprehension** objective | "The student must be able to] deduce that electricity flows in a closed circuit." [G3, p. 73] |
| 3) **Application** objective | "The student must be able to] give examples of elements and compounds." [G5, p. 79] |
| 4) **Analysis**, **synthesis** or **evaluation**[i] objective | "The student must be able to provide arguments to support the Copernican revolution[ii]." |
| 5) **Religion-related** objective | "Students must be able to talk about the power of Allah in the creation of the Earth." [G4, p. 56] |
| 6) **Health and safety-related** objective | "The student should be able to list good habits in maintaining the cleanliness of the premises." [G1, p. 59] |
| 7) **Social value-related** objective (family, community, etc.) | "The student must be able to mention the characteristics of the Muslim family." [G1, p. 17] |
| 8) **Jihad/war-related** | No available example in the corpus |

(B) Units that contained new content to be learned were coded according to their scientific sophistication or their non-scientific nature, where applicable. We did not have a sophistication scale sensitive enough to help us record small enough differences that could have contributed to answering our research question. Therefore, we proposed a scale, through a simple iterative process. This proposed scale can be described as in Table 2.

Table 2.
*Content Codes Used for Analysis*

| Code | Examples of acceptable units |
|---|---|
| 1) Information about objects or phenomena that takes the form of the presentation of a simple fact or image, usually available by **ordinary observation** or **through current media** | "Animals are [living] beings that need food." [G5, p. 33] /Image of the Earth [G2, p. 51] |
| 2) …presentation of a simple fact or image, **only available by systematic observation or the use of a scientific instrument** | "The electric current flows through objects made of copper or aluminum because they are electrically conductive materials." [G3, p. 81] |
| 3) …presentation of a simple fact or image, **only available by scientific work** (experiments) **or the work of professional scientists or scientific communities** | "During the formation of the seed, it is essential that the pollen be transferred into the ovary (the female organ)." [G5, p. 29] |
| 4) Scientific **explanation or conceptualization** | Diagram showing the mechanism of pollination and fertilization [G5, p. 30] |
| 5) Scientific explanation or conceptualization that presents or examines the **criteria**, **processes or historic facts** by which they gain scientific or truth **value**[iii] | e.g.: Story of the discovery of vaccines by Pasteur/Why people often believe that clouds are made of vapour/How we know that there were dinosaurs in Earth's past, etc. |
| 6) Scientifically **defective** affirmations, concepts or explanations (scientific **errors**) | "Rainbows occur in spring" [G2, p. 70] /"Bats are a kind of bird" [G3, p. 68];"/Fish breathe air dissolved in water through their gills" [G2, p. 31] |
| 7) **Religious** information or image | "Allah the Almighty has created the eyes to see through them the things around us" [G2, p. 59]; |
| 8) Information or image related to **health and safety practices** | Viruses and microbes cause diseases but are very diverse and should be treated by consulting a doctor and taking the appropriate medication" [G5, p. 54]; |
| 9) Information or image related to **social values** | Photo of a man in traditional Arab dress who passed out on the floor, beside a large dish of oriental pastries [G3, p. 50] |
| 10) **Jihadist** or **belligerent** information or images | Food helps us to do many things like praying, fasting, jihad and other things [G1, p. 53] /Monochrome drawing of an automatic weapon [G5, p. 74] |

(C) The corpus also contained mere prescriptions or recommendations that we categorized within these possibilities (Table 3). These prescriptions were addressed to students as well as to teachers.

Table 3.
*Prescription codes used for analysis*

| Code | Examples of acceptable units |
|---|---|
| 1) Prescription/recommendation related to **religion** | "The teacher should read the (particular) Qur'anic verse several times and ask the students to repeat it with him" [G1, p. 88] |
| 2) Prescription/recommendation related to **health and safety practices** | We must wash our eyes with clean water every day" [G2, p. 61]; |
| 3) Prescription/recommendation related to **social values** | "It is also necessary to rationalize electricity consumption" [G3, p. 74] |
| 4) Prescription/recommendation related to **jihad/war** | No available example in the corpus |

(D) The corpus also contained pedagogical activities to be conducted in class. Here, we used a classic typology, described by Jean-Pierre Astolfi (Astolfi, Darot, Ginsburger-Vogel, & Toussaint, 1997, pp. 159-166), and often used to label science activities at the elementary levels (Thouin, 2006). We added a few details to this typology in order to record more subtleties and enrich our analysis (see Table 4).

Table 4.
*Pedagogical Activities Codes Used for Analysis*

| Code | Examples of acceptable units |
|---|---|
| 1) **Functional** activity (**activation** of anterior knowledge, free **discussion**, etc.) | "The teacher asks students what type of meat they eat and writes it on the board." [G3, p. 38] |
| 2) **Functional** activity (simple or directed **manipulation**) | "The teacher asks the students to bring some plants to show their roots, and also bring carrots, radishes and onions. He participates with the students in classifying the roots […]" [G5, p. 12] |
| 3) **Problem-solving** (open problems that able students to make at least one or a few choices related to resolution) | No available example in the corpus |
| 4) **Structuring** activity (conceptualization, summarizing, reinvestment, structured discussion, etc.) | "Write on the board the similarities and differences between the leaves of the plants" [G5, p. 17]; |
| 5) **Institutionalization** (recall, recapitulation, evaluation) | "Complete: The gills of the fresh fish are colored in ..... and the gills of the expired fish are colored in ....." [G1, p. 55] |
| 6) Activity with an objective of a **religious** nature | "The teacher discusses with his students the importance of the mosque in our life" [G1, p. 14] |

(E) Finally, units that were not relevant to our research questions were coded as "generic or functional information". For example, units taken from tables of content (which potentially could unnecessarily have duplicated content coding) or short phrases that ensured transitions from one activity to another, for example, were coded as such. These elements are of little interest for our research and will not be analyzed.

All these codes were intended to be exclusive of one another and have been compiled and presented in a visual/sequential mode, allowing readers to browse the entire corpus.

## Results

In this section, we will first give a general description of the corpus, and then analyze all coding solutions, one by one. For each, we will propose general interpretations, in preparation for the following discussion section.

### General Description

We were able to code more than 99% of all the sentences and images (items) in the corpus, most of the remaining items being of negligible importance. All items were attributed only one code or were cut in two in cases where one code could not account for their richness. No item had to be cut into three parts. Figure 2 shows all attributed codes and references to all items in the 1st grade science document (91 pages). The comprehensive analysis for other grades (2-5) is available by writing to the corresponding author (the same legend can be used for interpretation).

In this figure, columns refer to the four categories of codes presented above, and coloured numbers to the codes themselves. Black separators indicate a shift in themes. To provide a more summary view, we regrouped all kindred codes into broader categories, each associated with a different colour:

- concepts, events or phenomena about students' physical environment (**green**);
- scientific errors (**dark grey**);
- religious considerations (**blue**);
- health and safety practices (**orange**);
- social values (**purple**); and
- belligerent, war or jihadist elements (**red**).

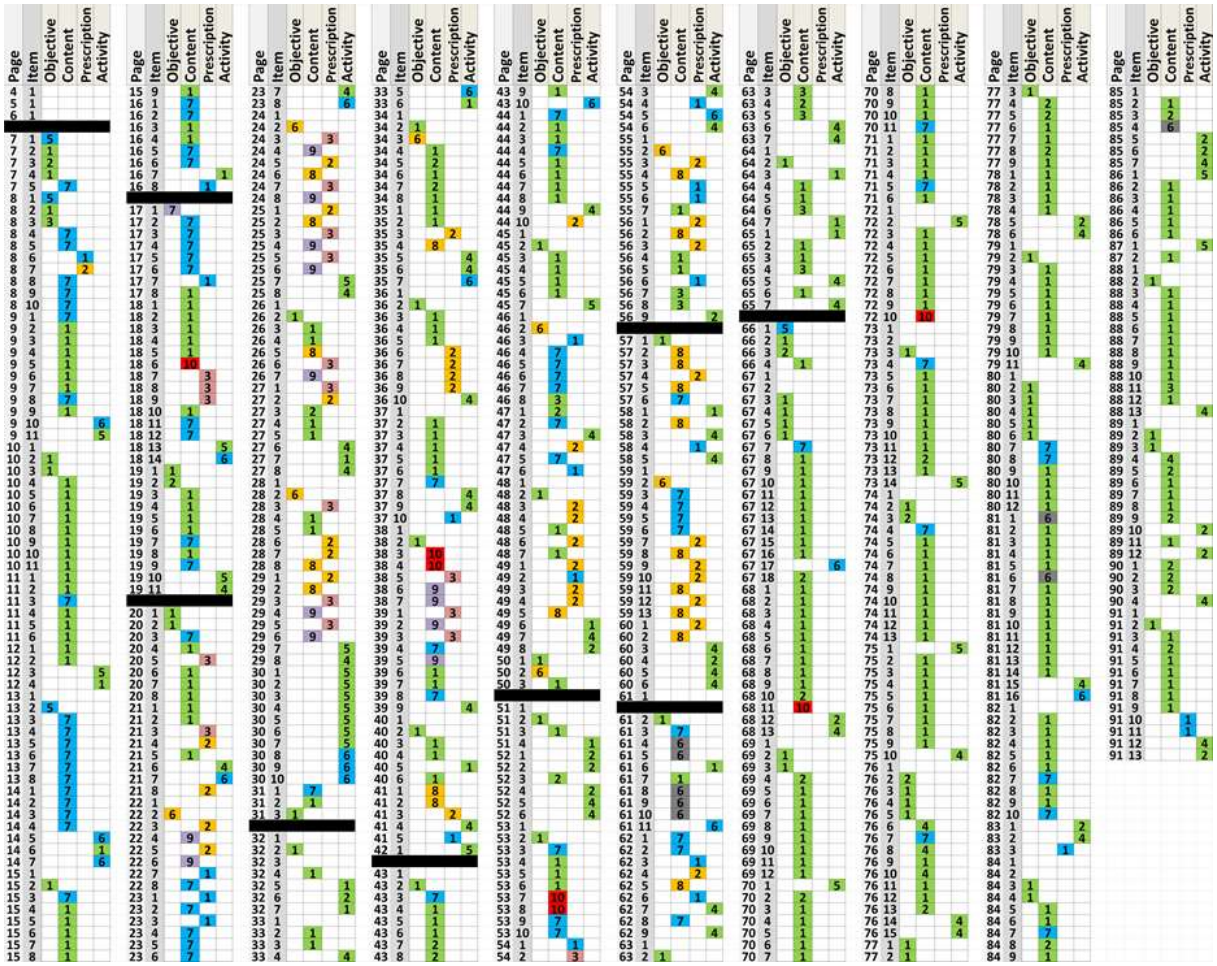

***Figure 2.*** Analysis of ISIS's 1st grade science program

Table 5 presents the number and percentage of coded items (total N= 3,203) that can be associated with each of these broad categories, by grade. Categories in Table 5 are arranged by code numbers (1, 2, 3..., etc.) and not by percentages or quantity. All tables below are also presented this way.

*Number and Percentage of Items of Each Broad Category, by Grade*

| | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| Concepts, events or phenomena (**green**) | 441 | 66 | 532 | 91 | 522 | 85 | 642 | 93 | 564 | 88 | 2,701 | 84 |
| Scientific errors (**dark grey**) | 8 | 1 | 17 | 3 | 32 | 5 | 23 | 3 | 46 | 7 | 126 | 4 |
| Religious considerations (**blue**) | 117 | 18 | 19 | 3 | 35 | 6 | 14 | 2 | 11 | 2 | 196 | 6 |
| Health and safety practices (**orange**) | 63 | 9 | 14 | 2 | 18 | 3 | 10 | 1 | 5 | 1 | 110 | 3 |
| Social values (**purple**) | 32 | 5 | 2 | 0 | 9 | 1 | 0 | 0 | 6 | 1 | 49 | 2 |
| Belligerent, war or jihadist elements (**red**) | 7 | 1 | 3 | 1 | 0 | 0 | 3 | 0 | 8 | 1 | 21 | 1 |
| TOTAL | 668 | 100 | 587 | 100 | 616 | 100 | 692 | 100 | 640 | 100 | 3,203 | 100 |

Hence, the science education program appears, at least in numbers, to be mostly about concepts, events and phenomena (84% + 4% = 88%). However, within this category, we can record a relatively high number of scientific errors (4%) considering that the corpus was made to promote the teaching of science. These errors appear to be more frequent as the levels get higher (from 1% for the 1st grade to 7% for the 5th grade). We also recorded some religious considerations (6%) which appear to decrease as grade levels increase (from 18% for the 1st grade to 2% for the 5th grade). Most health and safety practice and social value considerations seem to be concentrated in the 1st grade while belligerent/jihadist considerations are marginal, and appear almost only in the 1st and 5th grades (N=7 and N=8, respectively). We now turn to a more detailed analysis of this coding for each coding category.

**Pedagogical Objectives**

Table 6 presents the numbers and percentages of items to which we attributed the pedagogical objectives codes. Such items usually come at the beginning of documents, units and themes and make the teaching aims more explicit.

Table 6.
*Number and Percentage of Items for the "Pedagogical Objectives" Category, by Grade*

| | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| 1. Knowledge | 53 | 73.6 | 65 | 81.3 | 36 | 64.3 | 32 | 47.1 | 29 | 53.7 | 215 | 65.2 |
| 2. Comprehension | 5 | 6.9 | 11 | 13.8 | 15 | 26.8 | 29 | 42.6 | 22 | 40.7 | 82 | 24.8 |
| 3. Application | 1 | 1.4 | 1 | 1.3 | 4 | 7.1 | 6 | 8.8 | 3 | 5.6 | 15 | 4.5 |
| 4. Analysis, synthesis or evaluation | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| 5. Religion-related | 4 | 5.6 | 1 | 1.3 | 1 | 1.8 | 1 | 1.5 | 0 | 0.0 | 7 | 2.1 |
| 6. Health and safety-related | 8 | 11.1 | 2 | 2.5 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 3.0 |
| 7. Social value-related | 1 | 1.4 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.3 |
| 8- Jihad/war-related | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| TOTAL | 72 | 100 | 80 | 100 | 56 | 100 | 68 | 100 | 54 | 100 | 330 | 100 |

A very high proportion of the document's declared objectives aimed at *knowledge acquisition* and *comprehension* (total of 90% for these two), which are the two lowest levels of Bloom's taxonomy. We can, however, notice that *comprehension* objectives appear to be a little more common as students get older. We found only 15 objectives (of the 330 recorded) that were related to *application* (4.5%). These were mostly concentrated in the higher primary grade levels. We also found no trace of a single *analysis*, *synthesis* or *evaluation* objective. This entirely negative result is a little off-putting, since the category is rather inclusive. We thus have no choice but to suggest that the prescribed teaching objectives of these curricula are clearly concentrated at the very lowest levels of Bloom's taxonomy of complexity and specificity. We can therefore raise the question of its sophistication and modernity.

We found very few examples of other types of possible objectives, except maybe in the 1st grade, where we recorded four explicit objectives about *religion* (e.g.: "The student must be impressed by the power of Allah the Almighty who has created all that surrounds us and discover what are living beings and inanimate things." [G1, p. 66]) and eight that were related to *health and safety* (e.g.: "The student must mention the steps of healthy nutrition to preserve the health and safety of our bodies." [G1, p. 55]).

**Content to be Learned**

Table 7 presents the numbers and percentages of items to which we attributed *pedagogical content* codes.

***Table 7.***
*Number and percentage of items for the "Content" category, by grade*

| | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| 1. Available through ordinary obs. or through current media | 249 | 60.9 | 347 | 81.8 | 271 | 56.8 | 338 | 57.8 | 220 | 41.8 | 1.425 | 58 |
| 2. Available only through systematic obs. or scientific instruments | 25 | 6.1 | 26 | 6.1 | 92 | 19.3 | 132 | 22.6 | 104 | 19.8 | 379 | 15 |
| 3. Available only through scientific work | 8 | 2.0 | 8 | 1.9 | 42 | 8.8 | 56 | 9.6 | 119 | 22.6 | 233 | 9 |
| 4. Scientific explanation or conceptualization | 4 | 1.0 | 0 | 0.0 | 3 | 0.6 | 22 | 3.8 | 12 | 2.3 | 41 | 1 |
| 5. Examines criteria, processes or historic facts | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0 |
| 6. Scientifically defective affirmation (errors) | 8 | 2.0 | 17 | 4.0 | 32 | 6.7 | 23 | 3.9 | 46 | 8.7 | 126 | 5 |
| 7. Related to religion | 75 | 18.3 | 13 | 3.1 | 24 | 5.0 | 11 | 1.9 | 10 | 1.9 | 133 | 5 |
| 8- Related to health and safety practices | 20 | 4.9 | 9 | 2.1 | 5 | 1.0 | 0 | 0.0 | 1 | 0.2 | 35 | 1 |
| 9- Related to social values | 13 | 3.2 | 1 | 02 | 8 | 1.7 | 0 | 0.0 | 6 | 1.1 | 28 | 1 |
| 10- Related to jihad/war | 7 | 1.7 | 3 | 0.7 | 0 | 0.0 | 3 | 0.5 | 8 | 1.5 | 21 | 0 |
| TOTAL | 409 | 100 | 424 | 100 | 477 | 100 | 585 | 100 | 526 | 100 | 2,421 | 100 |

*Content codes* were attributed to most of the available items (2421/3203 = 76%). They thus allow a description of the information provided that is to be learned. The first observation that Table 7 allows is that most information (about 60%) is about rather trivial things that are immediately available through the simple observation of students' environments or through media; this is information that the students are probably able to grasp on their own and that they probably already know, without necessarily needing to have it explicitly taught to them. We can hardly consider this information as being truly of a scientific nature, since its assimilation requires no special instrumentation or systematic observation or inquiry. This information is not included within more complex (i.e., in relation to other knowledge) explanations or within embedding definitions. Most of the time, it is presented as simple declarative truths to be learned, in a rather absolutist manner (e.g.: "Living beings need water, air and food to live" [G4, p. 8]; "Light comes from the sun" [G2, p. 59]"; "Some living things move from one place to another (like humans and animals)" [G1, p. 71]). Some of these items are – or are supported by – photos of objects and living things, which very often illustrate long lists of examples.

Table 7 also shows that only 15% of all content is available only through systematic processes or observations (code 2), such as comparing notes in different contexts (e.g.: "Rainwater and rivers are not salty, unlike the water of the seas" [G3, p. 20]) or with the use of special instrumentation (e.g.: "The virus is a microscopic being, smaller than the bacterium, which cannot be seen with powerful microscopes but

through an electron microscope" (+ photo of papillomaviruses) [G5, p. 53]).

From grades 1 to 5, we can also see that there is an increasingly large number of knowledge elements that necessarily require scientific inquiry or the professional work of scientists or scientific communities to be available (code 3; e.g.: "The body then starts to produce antibodies in the blood to defend the body against viruses" [G5, p. 57]). Such culturally important scientific concepts encompass nearly 23% of all content at fifth grade, but unfortunately cover only a mean of 9% for the entire five-year cycle.

All these kinds of information or images, while clearly derived from systematic or scientific processes (code 2), or from historical production (code 3), are, however, generally presented in a rather dogmatic, decontextualized and isolated way, meaning that the processes involved are not necessarily discussed or presented, and that closely related knowledge elements are not necessarily expressed in conjunction. For such information or images, we used code numbers 4 or 5. Unfortunately, we recorded only 41 instances (out of 2,421) where explanations or conceptualizations were deployed (code 4), most of them in the 4th grade (mainly about biology, agriculture, and the Earth). A majority of them were mere definitions (e.g.: "Some animals, such as cows, sheep and rabbits, feed on plants and are called 'herbivores,' others, such as lions, foxes and cats feed on animals and are called 'carnivores'" [G4, p. 12]) or diagrams (e.g.: food chain [see Figure 3]). A very small number (N=5) provided true explanations: e.g.: "We can notice this when we look at ships. The first thing we see of the ship is its sail. If the Earth were flat, we would have seen the whole ship." [G4, p. 56]).

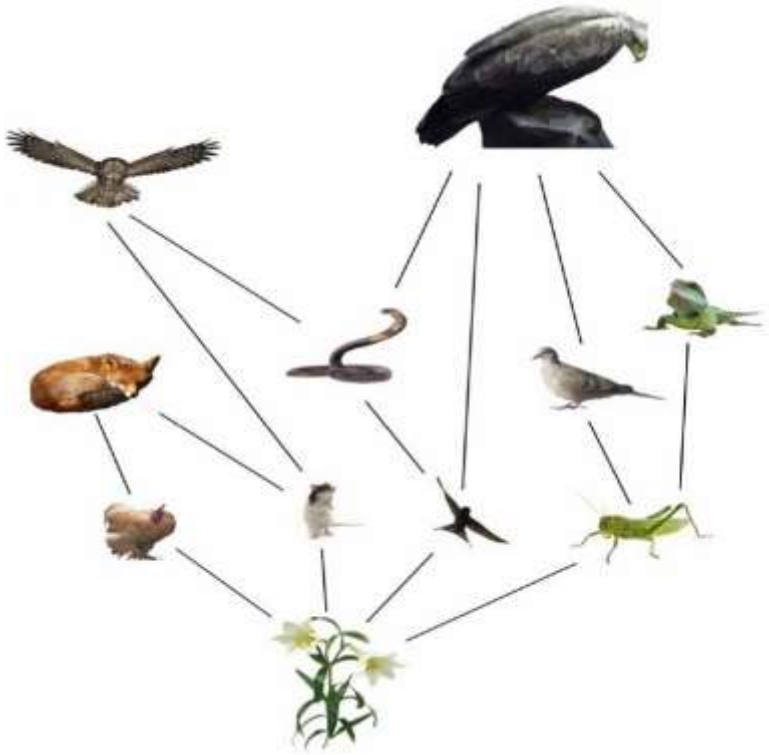

*Figure 3.* Figure of a food chain [G4. p. 22]

However, it is possible that the most remarkable result of our analysis is the *total absence* of scientific explanations or conceptualizations that present or examine the criteria, processes or historical facts by which these explanations or conceptualizations gained scientific or truth value (code 5). It is a little surprising to have found none, since such elements are the most emblematic of scientific thinking, and also because the category is quite inclusive. At some point, we thought we had found one item: "Among Arab scholars, Rhazes, who excelled in medicine, was the first to discover chickenpox" [G5, p. 55]. Unfortunately, after verification, it turned out to be an error[8], and the item was coded as defective scientific information (code 6). The absence of number 5 coding is, however, coherent with the declared teaching objectives (see section above), in which we found no ambition to develop any of these knowledge elements.

Nonetheless, we believe this total absence to be typical of a scientifically deficient set of documents, considering their "science education" ambitions.

Scientific errors (code 6) appear in rather large numbers, especially at higher levels (N=126; 5% of all content). Most of these errors were recorded for declarative knowledge that is true in most cases but not in all applicable ones (e.g.: "Invertebrates, such as cockroaches, ants and locusts, live on the land" [G4, p. 41][9]), but some of them were just plain false (e.g.: "It is possible to separate the constituent elements of a compound by either heating or electrolysis" [G5, p. 82]). The corpus presents a very large number of enumerations and categorizations, and many of them are highly debatable. For example, animals are categorized as mammals, fish, amphibians, reptiles and birds, but this categorization omits invertebrates, which account for most animals and most animal species.

However, our categorization of *scientific errors* might disputable, since some of them might be attributable to translation mistakes or compromises. They can also be attributable to honest and conscious attempts at making difficult subjects accessible to young minds through a legitimate didactic transposition (Astolfi et al., 1997). Our coding of errors therefore led us to difficult discussions within our research team. However we understand that even if some of our classification decisions might be questionable, the total number of scientific errors in the corpus still appears rather high, and we can affirm with little doubt that when topics are more advanced (4th and 5th grades), errors become much more frequent.

Items coded for "religious information or image" are among the most interesting of the corpus (N=133). Mostly concentrated at the lower levels, most of these pieces of information or images are references to scriptures (e.g.: "The Almighty said, 'We have certainly created man in the most perfect form' (Surat At-Tin/The fig tree, verse 4)" [G1, p. 31]) or simple religious declarations (e.g.: "Allah has replaced them [my old teeth] with new, strong teeth" [G1, p. 44]). Many were also merely religious images (men saying prayers [G1, p. 62]). What is most remarkable might be that these items are scattered throughout the documents, generally unannounced, and undifferentiated from other informational elements. For example, the sentence "Allah the Almighty has given us light and made the sun one of its sources" [G2, p. 63] appears in the middle of a lesson on light. Another: "Glory to Allah (He created all kinds of creatures)" [G3, p. 68] appears in the middle of a list of bird species. On another occasion, in the middle of scientific information about the cycle of water, a Surah[10] about winds and clouds is presented.

In many instances like these, scriptures or religious declarations appear to support the scientific facts presented, in an almost *decorative* way. On at least one occasion, scientific facts about the Sun-Earth system seemed to support the Qur'an as much as it can support scientific knowledge: "The Almighty said, The sun cannot catch up with the moon, nor the night get ahead of the day; and each is on an orbit." (Surah Ya-Sine, verse 40 [G4, p. 56]).

We did not find any form of opposition between science and religion in the corpus. However, an uneven distribution of religious information and illustrations and their quasi-aesthetic function leads us to believe that the authors essentially conducted a cherry picking operation, inserting verses of the Qur'an into the documents to enhance themes for which keywords appear both in sacred texts and in typical school manuals: light, water, earth, growing plants[11], sickness[12], beasts[13], mosquitoes[14], spiders[15], etc. Nevertheless, we found no religious declarations in units about chemistry, electricity, ecology and bacteria (except for diseases), and very few in botany and reproduction. Indeed, for themes such as these, which are scientifically and sophisticated themes, there are few possibilities to find echo in a seventh century. For many of the verses included in the corpus, only one keyword connects them to current scientific content. So the rationale justifying their presence in the corpus is always rather thin, and could better be explained by an agenda other than scientific.

A limited amount of data and images about health and safety practices and social values (codes 8 and 9) were recorded, and most appeared in first grade. However, it is interesting to note that many of the images in this category (as well as in others) contain photos or drawings in which faces are always blurred (even for some animals), and the very rare representations of women always involve covering their entire bodies with burkas.

*Figure 4*. Figures taken from 1 st and 3 rd grade documents (Muslim family; burkas; blurred faces of men and animals) [G1, p. 17; G3, pp. 28 & 65].

We also found very few examples of belligerent or jihadist information or illustrations (Total N = 21). Seeing these can be rather unsettling for Westerners. It is also a little surprising to see that these elements are dispersed and "buried" among lists of more neutral elements, or placed in the background of rather commonplace content. Consider this sentence, taken from page 53 of a 1st grade document: "Food helps us to do many things like praying, fasting, jihad and other things." This page shows photos of child soldiers (masked and armed; see Figure 1), inserted between a photo of food and another of people praying.

Most of the materials recorded under code 10 are simple photos or drawings of automatic weapons or people manipulating them. Even though many school programs used by ISIS have clear belligerence or hatred objectives and content, we cannot say that they are reflected in this specific science program.

**Prescriptions/Recommendations**

Table 8 presents the numbers and percentages of items to which we assigned the *prescriptions/recommendations* codes. These codes were attributed to all items that exercise a positive or negative value judgment on possible things to do/not do. They can be addressed to students as well as to teachers.

Table 8
*Number and Percentage of Items for the "Prescriptions/Recommendations" Category, by Grade*

| | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| 1. Religion-related | 22 | 29.3 | 3 | 42.9 | 4 | 22.2 | 2 | 16.7 | 0 | 0.0 | 31 | 26.7 |
| 2. Health and safety-related | 35 | 46.7 | 3 | 42.9 | 13 | 72.2 | 10 | 83.3 | 4 | 100 | 65 | 56.0 |
| 3. Social values-related | 18 | 24.0 | 1 | 14.3 | 1 | 5.6 | 0 | 0.0 | 0 | 0.0 | 20 | 17.2 |
| 4. Jihad/war-related | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0,0 |
| TOTAL | 75 | 100 | 7 | 100 | 18 | 100 | 12 | 100 | 4 | 100 | 116 | 100 |

Most prescriptions or recommendations recorded are about *health and safety* (56%; e.g.: "We must not use the towels of other people" [G2, p. 61]), while religious ones (26,7%; e.g.: "…underline the need to thank Allah for this gift [feet]." [G1, p. 41]) appear in second place. The majority of all recommendations appear in the first grade document (75/116), very few in the other levels, and almost none in 5th grade (N=4, all related to health [in these cases, mostly about possible poisoning and contamination]).

It is interesting to see that, among the "prescription/recommendation" items of the corpus, there appears to be more religion-related items than other kinds of items. We believe that this supports the hypothesis that the corpus has significant indoctrination ambitions.

**Pedagogical Value of Prescribed Activities**

Table 9 presents the numbers and percentages of items to which we attributed the *pedagogical activities* codes. Such activities can be found scattered about everywhere in the documents, but are also sometimes concentrated at the beginning (codes 1 and 2) at the end of units or themes (especially codes 4 and 5).

Table 9.
*Number and Percentage of Items for the "Pedagogical Activities" Category, by Grade*

| | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| 1. Functional (activation/free discussion, etc.) | 15 | 13.4 | 6 | 7.9 | 7 | 10.8 | 13 | 48.1 | 6 | 10.7 | 47 | 14.0 |
| 2. Functional (manipulation) | 15 | 13.4 | 13 | 17.1 | 22 | 33.8 | 4 | 14.8 | 21 | 37.5 | 75 | 22.3 |
| 3. Problem-solving (open problems that involve choices) | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| 4. Structuration (conceptual, synthesis, reinvestment, structured discussion, etc.) | 45 | 40.2 | 36 | 47.4 | 12 | 18.5 | 0 | 0.0 | 18 | 32.1 | 111 | 33.0 |
| 5. Institutionalization (recall, recapitulation, evaluation) | 21 | 18.8 | 19 | 25.0 | 18 | 27.7 | 10 | 37.0 | 10 | 17.9 | 78 | 23.2 |
| 6. Religious activity | 16 | 14.3 | 2 | 2.6 | 6 | 9.2 | 0 | 0.0 | 1 | 1.8 | 25 | 7.4 |
| TOTAL | 112 | 100 | 76 | 100 | 65 | 100 | 27 | 100 | 56 | 100 | 336 | 100 |

Except for the religious activities (7.4%; e.g.: "The teacher should read the Qur'anic verse several times and ask the students to repeat it with him." [G1, p. 61]), the distribution of different types of activities in categories 1, 2, 4 and 5 may seem relatively commonplace, and could be expected of most education systems around the world.

Most of the type 1 and 2 activities were essentially opening questions (e.g.: "Reflect: What would happen if there was no water in life?" [G2, p. 55]) or manipulation activities (e.g.: "The teacher asks the students to bring objects that allow light to pass through them, objects that do not allow light to pass through them, and others that partially allow light to pass through them. The teacher participates with students, in class, to classify objects according to their transparency." [G2, p. 64]). Often, such activities were also about classifying photographs or images. While repetitive, some of them were in fact rather interesting and typical of good introductory activities.

A very large majority of category 4 and 5 activities were lists of recapitulative and single-answer questions to be answered (e.g.: "List the causes of air pollution" [G4, p. 32]). They also involved classification, or were mere phrases to be completed ("fill-in" blanks). These activities were also rather typical of institutionalization activities commonly seen in the Western world, except that they practically never went as far as discussing the criteria by which answers are correct or not[16].

However, it is striking to note that we did not find any trace of type-3 activities. Indeed, all the manipulative activities recorded aim at resolving *well-defined* problems [or *closed* problems (Boilevin, 2005)]. Such problems are usually highly prescriptive and guiding, with few possibilities of granting responsibilities, choices, or decisions to students. On the contrary, open activities or problem-solving (or situation-based problems) usually suggest that at least more than one "correct" answer or satisfactory production is possible, and suggest that many different solution itineraries can also be considered. They are also more representative of true scientific thought, because they involve critical thinking and epistemological considerations, even if these can be rudimentary. Most modern curricula propose type-3 activities, even if they pose important classroom management challenges. In fact, type-3 activities are often considered *central* in the development of scientific thought and functional (types 1 and 2), and structuration activities (types 4 and 5) are often essentially justified by their supporting role in the *functional-problem resolution-structuration* triad (Astolfi et al., 1997).

Therefore, it can be defended that the corpus examined essentially focuses on the more traditional "*transmission –memorization/repetition- application*"

cycle. This is consistent with what we noted in the content section, where we noted an absence of mentions of the processes or criteria by which scientific value can be granted to knowledge elements.

## Discussion

As a totalitarian power over a part of Iraq and Syria (The *Levant*), ISIS had, for a certain time, the absolute authority to impose its views in many ways including via its education system. While some subjects, such as the arts (music), were completely excluded, science survived these cuts. The fundamental reasons for this will probably elude us forever. Is it because it would have appeared foolish to deny and neglect the explanatory, predictive and technological powers that science has developed and provided over the years, and that everybody can witness in our daily lives? Is it because ISIS wanted to capitalize on the important, positive and crucial historic role that the Muslim world played in medieval science? Nevertheless, a set of science education documents, a state curriculum, was created in this difficult and violent context. To what extent was it actually implemented? We do not know. We only know it existed.

A wide variety of different science curricula exist worldwide, mandated by all types of governments, who decide what components, objects, or consequences of science should be taught in schools. ISIS also had this freedom and gave a certain shape to their intentions, which is what this research project undertook to analyze. Looking at the data, it is possible to argue that it might be, as Olidort puts it, the result of an *ISization* process:

> "This pedagogical program, which I have termed ISization, refers to how the group repackages subjects outside the purview of religious studies, such as history or mathematics, to justify its cause and, where relevant, trains children to fight for it." (Olidort, 2016, pp. 9-10)

We argue that our analysis shows that the ISIS science education curriculum for the elementary levels can be viewed as (1) committed to an absolutist/totalitarian ideology, (2) inspired by a theocratic political program and (3) scientifically and pedagogically poor.

We argue that the corpus analyzed was (1) *committed to an absolutist/totalitarian ideology* because of a general *normalization* and *levelling* of discourse elements of very distinct types, whether social, scientific, belligerent, religious, etc. The documents juxtapose such items in a disordered and apparently alternating fashion (see for example figure 2), without characterizing their differences, and without addressing their origins. It is unlikely that a 6- or 10-year-old child could make such distinctions by himself. For example, since scientific truths are presented alongside, and in the same format as, religious truths, it is unlikely that a student would be able to view the Qur'an as something other than a natural science book[17]. However, when distinctions are indeed established, it is almost always in absolute *true* (religion, science) or *false* (vice, ignorance) terms. We see all sorts of this kind of absolutism in the corpus. In essentialist tones, things are presented as recommendable or unrecommendable (e.g. "You must eat many fruits [G3, p. 50]), good or bad (e.g. "Certain reptiles are harmful, like serpents" [G3, p. 69]), healthy or toxic (e.g. "Soft drinks cause diseases" [G3, p. 49]), true or false (e.g. "A sick person feels pain and a healthy person does not feel pain" [G1, p.61]), useful or useless (or harmful[18]) (e.g. "Decomposers exist in two categories: useful and toxic" [G5, p.45]), etc. We also see nothing that might trigger the development of critical thinking or that addresses truth criteria.

Thus, most of the value judgments in the corpus have utilitarian purposes and promote good social behaviour, submission to religion, healthy habits, respect for the family and, of course, praise for ISIS. In this context, it is not surprising that they are presented as simple truths (Delhaye, 2014). There is no apparent thirst for knowledge for its own sake, but only for what it allows or promotes. In this very non-constructivist and anthropocentric, action-centred context, we see no interest in invariants or criticism; only a juxtaposition of content that may eventually prove *useful-for-functioning-in-real life*. For example, entire units are devoted to "the advantages for man" of electricity; water, air, and plants [G3].

We also argue that the corpus was (2) *inspired by a theocratic political program*. Typical of other Islamic States and other more moderate Muslim settings, the corpus revealed no hints of denigration or discourse pitting science against religion. However, despite an apparent non-aggression pact and even with declarations of mutual support between science and religion (There is a lot of alternation between scientific and religious declarations –as can be seen in figure 2), our corpus shows clear pressure for subordinating science to religious discourse. For example, Allah is often presented as the engine driving scientific phenomena:

- "Allah the almighty has given our body means of defense to protect us against diseases." [G5, p.55];
- "By the grace of Allah, physicians have discovered vaccines for many diseases like measles, chicken pox, etc." [G5, p. 58]; and
- "…Allah the Almighty who created the eyes to see things around us." [G1, p.59]

And also, some content appears to have been chosen specifically to illustrate the greatness of Allah (i.e. "Man and thins around him" [G3]), even if such "demonstrations" often rely on a single, fragile common keyword, like "creation" [G3, p.83].

As illustrated by the Qur'anic cherry picking described above, there is little doubt that science's credibility is used to fuel the credibility of religious discourse. Some important omissions also betray the utilization of science. For example, a full unit about *human reproduction* [G3][19] was reduced to population considerations (e.g.: demography). Also, the only time that concepts of the mechanisms of human reproduction are mentioned, it is in a very general and scientifically useless sentence that involves divinity: "Allah created man with a drop of sperm, then through adhesion and then an embryo [normally] formed […]." [G3, p. 64].

However, we must remain cautious: since the scope of application of science seems limitless, whereas the time available for school subjects is always limited, school systems have to make difficult choices, and it is therefore impossible to be sure that an omission is political in nature. It is nevertheless possible to affirm that some of these omissions were ordered through certain directives we know were explicitly issued by ISIS Ministry:

> "The full text of the decision, published on August 2, 2014, stated [among other things]: A) We must remove from the teaching of science all that relates to the theory of Darwin, creation by nature or creation from nothingness, and connect all creation to God the Almighty. B) It must be systematically recalled in the teaching of physics and chemistry that all physical and chemical laws are laws of divine origin instilled by God in his creation." (Arvisais & Guidère, 2018b).

Therefore, if we acknowledge the *instrumentalization* of religion by ISIS for the implementation of its political program, it is difficult to fail to acknowledge that science has been *instrumentalized* as well, through a ripple effect. In this view, science can be seen as fuelling religion, which fuels ISIS's policies. Considering this two-tier forced subordination, it is not surprising that the general scientific quality of the so-called science programs has considerably suffered.

Indeed, we argue that our corpus was (3) *scientifically* and *pedagogically poor*. Indeed, many of our results support this conclusion:

- Pedagogical objectives that focus almost exclusively on the two lowest levels of Bloom's taxonomy of complexity and specificity, and especially on the first level (knowledge) (see Table 6). None were at the "Analysis, synthesis or evaluation of knowledge" level;
- "Scientific" content that focuses 60% of the time on commonsense and declarative knowledge (see Table 7), practically always proposed in an authoritarian and unquestionable manner and/or for utilitarian purposes;
- A total absence of knowledge that support or threaten truth value (See Table 7: 0.0% of content items that "examine criteria, processes or historic facts");
- A relatively large number of scientific errors (See Table 7: 126 content items that are "Scientifically defective affirmation"), especially for more advanced themes;
- The total absence of open problems to be solved (See Table 9: 0.0% of content items that require "Problem-solving (open problems that involve choices), while still promoting many (a) functional and (b) structuring activities (practically always in this sequential order);
- In the overall analysis, we also sometimes saw a lack of coherence between the objectives and the proposed content/activities. On the one hand, content that was not explicitly targeted sometimes receives thorough treatment (e.g. "creation", [G3]), while, on the other hand, some objectives were handled with sparse content or few activities (e.g. "reproduction" [G1]).

All these interpretations point to an understanding of our corpus as being far from an endeavour of scientific emancipation, but rather as an indoctrination to commonsense facts that have strong functional and useful purposes. The main challenges of *science*

*education* and of *science didactics* usually about resolving the tension that exists between commonsense knowledge (Talanquer, 2006) and scientific knowledge (Shtulman & Harrington, 2015). In that matter, a very strong tradition and program of research and intervention labelled "conceptual change" (Duit, Treagust, & Widodo, 2008) is emblematic of the kind of very relevant didactical problems that any "normal" science teacher encounters every day in his class (Vosniadou, 2008). However, in its science education programs, ISIS has somehow managed to completely avoid this problem and focus instead on rote memorisation[20]. This can be thought of as typical of dogmatic programs and not of educational ones.

The total absence of intentions and means of developing critical thinking of any sort is also cause for concern. The corpus contains a lot of content which, despite being presented inadequately and sometimes erroneously, are nevertheless easily retrievable, authentic products of scientific work of the past, or of scientifically carried out systematic processes. However, as Bachelard put it:

> "[…] the teaching of the results of science is never scientific teaching. If we do not explain the spiritual production line that led to the result, we can be sure that the student will combine the result with his most familiar images. He must understand. One can only remember by understanding. And the student understands in his own way." (Bachelard, 1967, p. 234)

In the same line of thought, Henri Poincarré wrote: "We do science with facts, like we make a house with stones, but an accumulation of facts is no more a science than a pile of stones would be a house." (1902, p. 136). We searched for such order or coherence of a scientific nature in our corpus, but we were only able to find coherence of a possible pedagogical nature (from more simply presented content [1st grade] to content presented in a more complex manner [5th grade]). This interpretation, combined with the observation of the doctrinal form of the knowledge presented, lead us to think that science is not studied for itself, but for other purposes, and has indeed suffered from this imposition. It goes without saying that the absence of consideration for the nature of science (NOS) or for epistemological content, as seen in related contexts (Asghar et al., 2014), is not very surprising.

As science educators, we also regret that the very young children who studied under ISIS were not exposed to a certain number of themes, content, or perspectives – elements that we judge to be fundamental and essential to science and scientific evidence, even at the primary level, even if these are only studied in their most basic forms. Among these, *measurements* are never considered in the program. Students never take them, and they are never referred to. Reproduction and evolution are never truly addressed, nor are other considerations, such as scientific laws, inquiry and investigative skills (Aldahmash et al., 2016)[21], natural mechanisms, models, experimental comparisons, and engineering. Also, counterintuitive facts or models that involve possible reconfigurations of knowledge through cognitive conflict are not part of ISIS's science teaching process. But as humans, we also believe that, in the end, all these concerns do not hold much weight, considering the fact that these children were raised in a totalitarian, repressive and extremely violent environment known for systematically developing submissiveness and hateful attitudes.

## Conclusion

We conducted an analysis of ISIS's primary science education program, which was developed under a totalitarian theocratic regime. This analysis allowed us to make a value judgment about the level of scientific thinking that can possibly exist under such authoritarian pressure. We here argue that, like the programs themselves, the answer to this question is unambiguous: not much.

It is nevertheless possible that our analysis of an ultimately short-lived as well as extreme political moment (i.e., the historical anomaly that was ISIS) could be limited. Indeed, results obtained in extreme contexts (and the conclusions that emerge from such research) might very well be restricted to their own contexts. However, we also think that, through a deontological (Kantian) analysis (Strathern, 1997), our results still might be useful to all educators willing and striving to develop and maintain the quality of science education, whether in the West or not. In the context section, we described the problems that science education has to overcome due to religiously driven political attacks on its integrity and principles, for example, in certain states of the U.S. or countries of Europe, such as Greece. We think that the ISIS example is clear: when science is forced to be studied for other reasons than itself, its quality almost necessarily deteriorates. Science is a democratic endeavour that requires absolute freedom for its

emancipation. It thus should be protected from all political interference, and as Dagher & Boujaoude suggested, should be separated from it (2011). Otherwise, it will cease to contribute to our societies, first by weakening scientific research and technological innovation, and secondly by producing citizens who lack scientific thinking and critical judgment.

Therefore, we believe that secularization principles should be adopted and protected, even in Muslim societies, where this challenge seems to be more difficult to overcome. We understand that Islam often aspires to occupy all spheres of life. But even though in most Muslim settings, scripture and science are not considered incompatible (Guessoum, 2010), it could still be detrimental to the natural development of scientific thinking to allow or encourage religion to impose its doctrine on educational undertakings, even in small doses. This could also be detrimental to the general quality of education systems. This devaluation can also be seen through international standardized testing, as Dagher noticed for Arab countries (Dagher & Boujaoude, 2011). And indeed, while examining our corpus, we came to believe that ISIS was unable to offer a program worthy of the Arab scientific heritage.

In the end, we also hope that our analysis will lead to a better understanding of the realities that children experienced under ISIS, and, based on these results, contribute to the reconstruction of the education system in Iraq and Syria, including through the "Revive the spirit of Mosul" initiative, lead by UNESCO (2018).

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## Endnotes

[1] Which appeared around 2013 [Ibid, p. 120] and included [Islamic] courts.
[2] The name of the project is borrowed from the first man (1897) to conduct demographic studies in the Kirkuk region (where textbooks were found): the Ottoman encyclopaedist Shamsaddin Sami.
[3] Unidentified (anonymous) authors (2015a, 2015b, 2015c, 2015d, 2015e).
[4] *Science and Technology Education Research Team* (EREST/STERT).
[5] All this material was also found on the "darknet," thus validating its existence and use.
[6] It ends with: "… By the grace and help of Almighty Allah, the Islamic State is entering a new era by laying the foundation stone for Islamic teaching based on the Qur'anic approach and the prophetic guidance and based on the understanding of the way of the venerable ancestors and the first pious predecessors (of the Prophet) and by a clear vision, neither Eastern nor Western, but prophetic, Qur'anic that moves away from passions, heresies and impostures emanating from missionaries of Eastern socialism and Western capitalism or agents of vicious parties and movements around the world. Once these blasphemous influxes and heretical slips had obviously left an impact on the sons of the Islamic Umma (community), it fell to the State of the Caliphate - by the help of Allah the Almighty - the heavy burden to put them back on the virtuous path of Unitarianism and the immense greatness of Islam under the banner of the well-guided caliphate that rises like a majestic tree and shelters them under its shadow after the demons dragged them to the chasms of Jahiliyya/ignorance (the pre-Islamic era of ignorance) and its perilous paths. Today, the Islamic State begins this project by developing a new program for which no effort has been spared to follow the example of the first pious predecessors, ensuring that it complies with the Qur'an and with the Sunna (the prophetic tradition) and that it draws its matter in all fidelity without any heresy nor any distance, at a time when falsification, faking, hatred and excess have multiplied. The development of these programs is a first step on the road and a foundation stone in the construction of the Caliphate building. What was written is the result of a great effort, so if we succeeded it is thanks to Allah and if we failed it is by ourselves and the devil, Allah and His prophet are blameless and we accept the advice and recovery from any partisan (ally/friend), and as the poet said: If you find a defect, correct the Glory to the flaw. Almighty, He alone is flawless."
[7] Except in the fifth grade, where a few themes are developed in a more coherent fashion.
[8] Razi (or Rhazes) was, however, the first scientist to differentiate chickenpox from other diseases.
[9] Most invertebrates live in water.

[10] "The Almighty said: 'He sends the winds as an announcement of His mercy. Then, when they carry a heavy cloud, We lead it to a dead land, then We bring it down, and then We bring out all kinds of fruit. So we will bring out the dead. Perhaps you will remember.' (Surat Al-A'raf, verse 57)." [G2, p. 46]
[11] The Almighty said: "So you see the parched earth: as soon as We bring down water, it moves, swells, and makes all kinds of splendid couples of plants grow." (Surat Al-Haj/The Pilgrimage, excerpt from verse 5). [G4, p.66]
[12] "The duaa (prayer) of the Prophet to the sick man: 'I implore Allah the Almighty to heal you.'" [G1, P. 62]
[13] The Almighty said, "No beast walking on earth, no bird flying with its wings, who is not like you in community. We have not omitted anything to write in the Book. Then it is to their Lord that they will be brought back." (Surat Al-An'am - The cattle, verse 38) (error in the given number) [G2, p. 9].
[14] "Surely, Allah does not hesitate to cite as an example anything: a mosquito or anything above it" (Surat Al-Baqara/The Cow, excerpt from verse 26). [G1, p. 82]
[15] "But the most fragile house is that of the spider. If only they knew!" (Surat Al-'ankabut/The Spider, from verse 41). [G1, p. 82]
[16] It is not impossible that such a task is considered to be the teacher's responsibility. However, if this is the case, it remains entirely implicit.
[17] Taşkın had already suggested that some Muslims believe that "reality can only be found in the Qur'an" (Taşkın, 2014).
[18] "Changes affect materials. Some are useful, others are harmful. When iron is exposed to moisture, it oxidizes. It is a harmful change because it causes the deterioration of the material. But when the baker turns dough into bread, it's a useful change. It is the same for the carpenter who cuts wood; it produces a useful change." [G5, p. 77]
[19] However, considerable time is spent on the topic of plant reproduction, which is studied in almost every school year.
[20] This is seen in most Arab countries, as reported by Dagher & Boujaoude (2011)
[21] This omission has also been noted in the curricula of Saudi Arabia.

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