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Collaborative Epistemic Discourse in Classroom Information Seeking Tasks

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Collaborative, Epistemic Discourse in Classroom Information Seeking Tasks

We discuss the relationship between information seeking, and epistemic beliefs – beliefs about the source, structure, complexity, and stability of knowledge – in the context of collaborative information seeking discourses. We further suggest that both information seeking, and epistemic cognition research agendas have suffered from a lack of attention to how information seeking as a collaborative activity is mediated by talk between partners – an area we seek to address in this paper. A small-scale observational study using sociocultural discourse analysis was conducted with eight eleven year old pupils who carried out search engine tasks in small groups. Qualitative and quantitative analysis were performed on their discussions using sociocultural discourse analytic techniques. Extracts of the dialogue are reported, informed by concordance analysis and quantitative coding of dialogue duration. We find that 1) discourse which could be characterised as 'epistemic' is identifiable in student talk, 2) that it is possible to identify talk which is more or less productive, and 3) that epistemic talk is associated with positive learning outcomes.

Keywords: teaching methods, information behavior, information seeking, search engines, collaboration, epistemic dialogue, sociocultural discourse analysis, classroom talk

Introduction

Pre-selected reading lists and library materials are no longer the resource of choice for either teachers or children, who expect, and want, to be able to find and use information on the web (Bartlett & Miller, 2011). However, despite the prevalence of internet use among young children (Eynon, 2009), many experience difficulties in their web based information-seeking activities (Bartlett & Miller, 2011; Bilal, 2001; Eynon, 2009; OxIS, 2007). Information Seeking (IS) – the seeking of information, in particular via search engines – can be seen both as a tool in its own right, and a way to encourage children's critical interaction with a complex network of information; the World Wide Web. This paper suggests that IS is fundamentally shaped by the ways that information needs which serve problem solving and knowledge identification are

3

conceptualised by individuals when they search. This suggestion has lead Tsai (2004) to encourage thinking of internet-based instruction as not only:

> …a cognitive tool or a metacognitive tool; rather, it can be perceived and used as an epistemological tool [through which] learners are encouraged to evaluate the merits of information and knowledge acquired from Internet-based environments, and to explore the nature of learning and knowledge construction. (Tsai, 2004, p. 525)

As such, IS goes beyond 'information retrieval' (IR) in which the primary focus is on the return of matching results in search systems. Understanding the difficulties children experience when navigating information is bound up with understanding how students perceive the information they are seeking – their 'epistemic beliefs' about the nature of knowledge. In the following sections we discuss these beliefs, and their measurement, suggesting that IS provides a good research setting for the exploration of epistemic beliefs and that this exploration should focus on the analysis of discourse. The rest of the paper presents a small-scale study which illustrates our perspective, showing that discursive approaches are appropriate for probing epistemic beliefs in the context of collaborative IS, and discussing the relationship between these beliefs and the pupils' success in IS tasks.

Epistemic Beliefs and Information Seeking

It is our argument that the analysis of how search engines are used to seek information provides one novel means to investigate the ways that knowledge is conceptualised in action. Seeking, selecting and evaluating sources,, and making decisions about how to use information to complete a task, implicates the actor's epistemic beliefs. Their beliefs about knowledge and knowing – must be brought to bear both on individual items of information, and their relevance to task completion (Bromme, Pieschl, & Stahl, 2009). Indeed, recent evidence suggests that

students do spontaneously reflect about knowledge, and knowing, in online information searching (Mason, Ariasi, & Boldrin, 2011). Across the broad models of epistemic beliefs there is agreement on the importance of two key facets of belief: what knowledge is; and how one comes to know; as Table 1 indicates.

Table 1 – Epistemic dimensions

Epistemic area	Epistemic dimension	Description
Knowledge	Certainty of knowledge	The degree to which knowledge is conceived as stable or changing, ranging from absolute to tentative and evolving knowledge
	Simplicity of knowledge	The degree to which knowledge is conceived as compartementalised or interrelated, ranging from knowledge as made up of discrete and simple facts to knowledge as complex and comprising interrelated concepts
Knowing	Source of knowledge	The relationship between knower and known, ranging from the belief that knowledge resides outside the self and is transmitted, to the belief that it is constructed by the self
	Justification for knowing	What makes a sufficient knowledge claim, ranging from the belief in observation or authority as sources, to the belief in the use of rules of inquiry and evaluation of expertise

Table adapted from (Mason, Boldrin, & Ariasi, 2009, p. 69)

Measuring Epistemic Beliefs

The measurement of epistemic beliefs in the classroom environment provides an opportunity for exploration of localised, and co-constructed 'beliefs-in-action'. In this context, collaboration is of interest for two key reasons. Firstly, as outlined below, it is a frequent occurrence in real world IS; secondly, engaging in collaborative problem solving can have benefits for students both within and beyond the classroom (Howe, 2010; Wegerif, Littleton, Dawes, Mercer, &

Rowe, 2004). Traditional approaches to studying epistemic beliefs – including the oft-used

questionnaire – are likely to be inadequate for researching in this context, thus…

> *…some researchers (Hofer, 2004; Maggioni & Fox, 2009; Mason et al., 2011; Mason, Boldrin, & Ariasi, 2010; Mason & Boldrin, 2008) have further contextualised the study of epistemic cognition by moving beyond self-report inventories and using online think-aloud methodology (Ericsson & Simon, 1980).* (Ferguson, Bråten, & Strømsø, 2012, p. 106).

However, even these observational 'think-aloud' approaches are inadequate for the study of

collaborative work, and thus no study to date has taken this approach to dealing with co-

construction of epistemic beliefs – it is to closing this gap that this study contributes. In the

context of epistemic beliefs, Discursive Psychologists argue that we should not see beliefs and

communication as "two separate 'objects' that can affect each other, but as more integrated

aspects of cognition and/or behaviour" (Österholm, 2010, p. 242). This perspective describes

"the activity, the discourse, as the site where epistemological beliefs come to existence, through

explicit or implicit references to prior experiences (epistemological resources)" (Österholm,

2009, p. 262).

Österholm's argument is that his discursive perspective can be combined with Hammer and

Elby's (2003) perspective of epistemological beliefs within a 'resources' model, in which

epistemic beliefs are viewed not as fixed, or as developing cognitive models ranging over one or

more domains, but are rather seen as dependent upon the resources available to the thinker at any

time – in our case, discourse being seen as a key 'resource' through which epistemic beliefs are

navigated and co-constructed. Lazonder (2005) has explored this epistemic component of IS in

the context of collaborative educational tasks, suggesting that teenagers may be, "largely unable

to select appropriate search strategies (planning), check their progress (monitoring) and assess

the relevance of search outcomes (evaluating)." (Lazonder, 2005, p. 466). He thus suggests that

collaboration may help to overcome the "inert knowledge problem" (Lazonder, 2005, p. 466) in

that verbalisation amongst collaborators may contribute to the development of self-regulatory processes, prompting users into better negotiating the search process. Certainly, other research supports the view that engagement in dialogue is associated with the development of self-regulation and metacognition (Mercer, 2014). The implication here is that, by encouraging the creation of common ground or knowledge amongst collaborators, we facilitate better IS processes. However, Lazonder's was a small-scale study based on older students, in which, although talk or 'verbalisation' was deemed important for self-regulation, it was not analysed as a data form or co-constructive activity.

Other evidence highlights that, in educational contexts, collaborative IS is a frequent phenomenon (Amershi & Morris, 2008; Ba, Tally, & Tsikalas, 2002; Livingstone, Bober, & Helsper, 2005; SQW, 2011). However, these studies have focussed on professionals' perceptions – not those of students – (Amershi & Morris, 2008) or have used student self-report measures (Ba et al., 2002; Livingstone et al., 2005; SQW, 2011) as opposed to direct observation. By failing to explore collaboration in action we may be missing an educational opportunity to promote higher quality collaborative discourse, which has strong associations with educational outcomes (see the collection edited by Littleton & Howe, 2010)). Earlier work (Knight & Mercer, 2014) based on the same research-data reported here indicates the promise of such analysis of discourse in IS, although it does not discuss the specific epistemic context of information seeking. The work reported here recognises the importance of understanding the ways discourse helps to shape the epistemic properties of particular tasks, such as IS tasks.

Epistemic Beliefs and IS – a shared approach
Searching for and processing information require the identification of needs, and of information which meets those needs; these are thus issues regarding "beliefs about the nature of knowledge

and knowing, which may facilitate or constrain searching and evaluating sources of information on the internet." (Mason et al., 2011, p. 139).

Sociocultural psychology's focus is on the use of language as a tool for getting things done–language, *in use*. It thus recognises that analysis of language 'in action' at work in the world, provides important insight into the distinctive nature of human cognition. The focus is not on the verification of correspondences between linguistic labels and 'things in the world', but on the ways in which knowledge and language, as used in collaborative activity, is used to act on and in the world (Littleton & Mercer, 2013). The implication for discursive approaches to epistemic beliefs and IS is that information needs should be considered as they relate to community-based criteria for justification, and the purposes for which knowledge is deployed (e.g. practical v. academic nursing knowledge). Thus, the interest is not "what does it [language] represent? But, what is going on?" (Edwards, 1993, p. 218). In the IS context, this discourse can be seen as mediating the iterative and evolving process through which: information needs are defined; information needs are translated into search queries, and enacted (with more or less use of the sophisticated search engine tools); results from search queries are selected, ignored, and explored; and queries are used iterated on in order to refine and redefine the information sought. In the study reported here, we investigated IS processes of seeking and evaluating information through an analysis of the 'epistemic' discourse used in small collaborative groups. Our analysis attempts to confirm the epistemic nature of talk in IS contexts, and to understand how co-constructive language use shapes the seeking and evaluating of information.

Materials and Methods

Participants

Eight pupils – two groups of three, and a pair, as detailed in Table 2 – were selected from a Religious Studies lesson by virtue of seating themselves in self-selected groups at three PCs which had been setup as observation stations. All participants in the sample were female and between eleven and twelve years old.

Table 2 – Participant Prior Data

	Pupil 1	Pupil 2	Pupil 3
Group 1	33	31	n/a (a pair group)
Group 2	35	34	37
Group 3	34	Missing	35

KS2 average point score (level 5b is 33, 4b is 27, 3b is 21 (sub-levels in increments of 2, 5b-33, 5c-31, 4a-29, 4b-27, 4c-25, etc.)).

Ethics

British Educational Research Association (BERA, 2011) guidance was followed, with consent gained from the school and all parents/guardians of the class members prior to testing; no ethical concerns were encountered. Each participating pupil also gave verbal consent after a brief explanation of the purpose of the recordings.

Design

This study is best characterised as an observational study of collaborative talk, although the analysis of artefacts – worksheets, and screencast data – has some affinity with text analysis approaches. This sort of mixed method approach is common in sociocultural research, which tries to understand the relationship between participant's actions and the social and cultural context of those actions (Mercer & Howe, 2012).

Materials

Three flipcameras were used as a backup audio recording, and provide visual assistance in transcription. Three Roland Edirol R9 Audio Recorder**s** were used as the main audio recording devices, and placed in front of the keyboards on the work-desks. A classroom of desktop computers had Camstudio installed on them, and three of these in relatively isolated positions were selected as testing stations. Camstudio was set up to reduce file size as far as possible and to save onto a shared network drive for later 'collection'. These files were monitored at intervals throughout the session to ensure they were not growing too large. The worksheet was copied as instructed by the teacher, for one each group.

Procedure

Prior to the lesson starting, three computers were logged on to a generic pupil account and CamStudio was setup for use. The content and structure of the observed lesson was largely determined by the class teacher, although a PowerPoint presentation and lesson plan were provided for guidance. The lesson started with:

- A brief introduction to the task – to find out about role models
- A discussion of what a 'role model' is
- A discussion of what would be suitable 'ground rules' for working together in a group – listen to each other, share ideas, explain answers, etc. (Littleton & Mercer, 2013).

The pupils then worked through a worksheet, the first seven questions of which were 'assigned' or 'directed' tasks (find out about role model x) and the last two involving more self-directed tasks (pick a role model as a group, and find out about them). These appeared alongside

questions to probe epistemic cognition (the 'part b' elements) by asking about the usefulness, value and sourcing of information, as indicated in Figure 1.

The aim of this activity is to find out more about some people who might be good role models
The Nobel Prize is a prize given for achievements in physics, chemistry, physiology or medicine, literature and for peace. *How many women have won a Nobel Prize?*

What did you find?	How do you know the information you found is useful?
	Would some people say other information was better? Why/why not?

Where did you find this out?

Figure 1 - Example IS Question taken from Worksheet

The worksheet included 'open' and 'closed' questions. The former included asking pupils to explain why Marie Curie (Q1) and Nelson Mandela (Q3) are considered good role models, and researching their own example of a role model (Q8 and 9). The latter included asking pupils to find out how many women have won a Nobel Prize (Q2), finding a particular other name for Nelson Mandela (Q4), finding the name of a footballer from a set of given facts (played 700 games until he was 50, was never booked, died in 2000; Q5) and a URL to the statue of him (Q6), and finding the name (Florence Nightingale) of the person credited with improvements to nursing (Q7).

The teacher chose appropriate points at which to stop the pupils, ensure they were all moving along well, and check answers. The audio recorders were appropriate for recording these sections of teacher-led talk as well as recording the small groups when they were working on the activities. The lesson was a single 75 minute session of which about 65 minutes was spent working (roughly 10 minutes being spent on admin tasks). The teacher for this session was covering for a planned absence by the usual teacher. The pupils received one worksheet per group, and chose their own groups of two or three.

Analysis

Analysis was conducted on group talk transcribed from the audio recording[1], with video recording used to inform this analysis. Screencast data was – where relevant – also used as a secondary form of analysis to explore the context of utterances. Understanding the context of any activity is important for understanding how utterances are used by collaborators to think together. In 'systemic functional linguistics', the perspective is taken that types of text have contexts by being members of a particular genre, which is revealed through the way such texts are written[2] - thus, context is imbued into texts at the time of writing. However, extending this notion to the context of co-construction through discourse, we argue that "'context' is created anew in every interaction between a speaker and listener or writer and reader. From this perspective, we must take account of listeners and readers as well as speakers and writers, who create meanings together" (Mercer, 2000, p. 21). One particular technique for understanding the temporal aspects of context, as generated through talk, is to look for repetition of words so as to understand how "speakers can jointly, co-operatively create cohesion in…their speech" (Mercer,

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[1] Audio was transcribed with little technical notation except ellipses '…' to indicate overlapping speech, and relevant annotations made in square brackets (e.g. [inaudible] where the words could not be made out.)
[2] See Halliday, Hasan and Christie (1989)

2000, p. 62). Two elements of 'context' which are particularly salient here, are the screencast recordings and worksheet answers – both of which informed the analysis of talk, and offer useful insights into the epistemic cognition of the pupils.

Results

Following the analysis described above we now present our results, starting by highlighting the relative success of the groups in answering the worksheet questions. We then move on to discuss the epistemic nature of the worksheet responses, before offering a description of each group's epistemic talk and actions and their relationship to the task and search engine activities.

With regard to group success, we found that Group 1 completed four questions (one incorrectly) and had almost found the answer to the fifth question. Similarly, Group 2 completed all nine questions, but had given only superficial answers to questions eight and nine. They also failed to discuss question seven or the worksheet prompts regarding source quality and usefulness – a problematic omission for a collaborative task. Finally, Group 3 completed only three questions.

Talk was analysed for the presence of epistemic discourse alongside screencast data and answers entered on the worksheets. These latter artefacts provide insights into how problems were addressed in ways not captured by the talk alone. For example, one group added 'BBC' to a search query, indicating some belief that information garnered from the BBC is of a high quality in contrast to that which might be found at other sources.

For comparative purposes, the worksheets of all groups were collected. There is an interesting relationship between some of the epistemic beliefs expressed in the 'part b' questions which address the usefulness of information, and 'success' (as measured by correct answers completed) – as Table 3, which is organised by group-question 'success', indicates. Analysis of the

13

sophistication of these exemplars is complex; for example, the first 'everyone is using this website', and the last – in which the group uses nobelprize.org as much as possible – indicate two common shortcuts taken when trying to understand and access information: using commonly used sources, and authorities. However, while these are common, and in many ways sophisticated heuristics, they are not unproblematic as justifications for one's knowledge claims. The examples in the table provide a useful reference point for the talk, worksheet answers, and screencast data from the three analysis groups – to which we turn below – indicating that the kinds of discourse seen in our three groups were similar to those in other groups in the class.

Table 3 – Group epistemic comments from worksheet entries

Group	Correct answers	Epistemic comments
A	2	"everyone is using this website it said official as well" "it comes from the BBC which is well known and trustworthy"
B	3	"it's an official website" "we found it on BBC website and they are usually right" "because it's on Nelson Mandela's biography *[biography.com]* site" "because it was on a website that was about her"
C	3	"looking on the actual website", "used an official website", "because we went onto another website it had the same information" (q3/4)
D	3	"it tells the truth which makes it a good site", "because it told us what we needed to know about Marie Curie", "official site"
E	4	"it's detailed" "it's on the BBC website" "Because it's not told on other websites"
F	4	"official website", "it was on other websites so it must be true"[q2], "because it was shown on more than one website"
G	5	"because it's the official website", (q.1-4 answered from NobelPrize.org). (for each, used nobelprize.org throughout)

Epistemic talk – group analysis.

Group 1.

Group 1 – who worked on five questions in total – looked for descriptive accounts to answer

questions, emphasising 'detail' in their answers to the 'part b' questions. In a number of places

the group expressed understanding of context, for example exploring some of the differences in

female Nobel Prize winner's subject/discipline, and understanding of why this might matter.

While certainly this is appropriate – and it was good to see they wanted more detail on why the

women won Nobel prizes – this was not always an appropriate response, and in particular its

repetition lends weight to the suspicion that this acted as a "catch all" evaluation. They also

noted the importance of understanding *why* information might be important. For example, they

complained that the Nobel Prize website lacked detail on information significance, while

praising sources on Nelson Mandela for providing explanation regarding the importance of

information. Similarly, this group noted the importance of 'why' in the context of Marie Curie's

status as a role model – noting it was important to understand *why* she might be a role model, and

picking out pertinent facts to answer this question. Table 4 indicates some of these 'cohesive

ties' and their relationship to the discourse.

Table 4 – Cohesive Ties in Group 1's talk

Section	Tie	Examples	Commentary
Q1	"How many" Numbers (1,2,3,etc.).	"How many women?" "2 women were physics"	Focus on question but looking at wider context (numbers in various fields).
Q1b	"why" "she ___" (was/is/his years, etc.).	"Why they won it"	
Q2	"she ___" (won/was born/died, etc.)	"She won a prize in physics"	See Q3
Q2b	"why"	""Why she got the prize"	
Q3 link to q1/2	"nobel prize"	"He didn't win a nobel prize I don't think so"	Links back to Q1/2
Q3	"he ___" (was/is/his years, etc.). "stood up for"	"he was born on the" "he was in prison for standing up for his rights""	See Q2 Ties to Q3b below.
Q3b	"why" "stood up for"	"it tells us what happened and why" "he stood up for black people and his rights	Ties to Q1b above. Ties to Q3 above

Group 1 used the official Nobel Prize website (www.nobelprize.org) as the first port of call for each of the five questions they worked on. This might suggest its easy use in the first two questions and slightly more challenging use on the third and fourth, provided a frame or heuristic device for them. This repetition may also indicate some implicit rules they have used regarding the connectedness of tasks. From the data these distinctions are difficult to make, but their movement away from this site for later questions may provide support for the notion that researchers should look at the resources available for satisfying particular needs, and understand epistemic cognition in that context. While at one point this group expresses preference for one website because it offers more detail than other sites, at other points it seems that they think that

the level of detail they have is all there might be to know. This tendency may be subject-specific; however it may also be a more general indication regarding their beliefs regarding the simplicity of knowledge. At only one point did this group read an opinion or fact and repeat it without checking it in any way

When Group 1 used Google to search, their scrolling behaviour and activation of links indicated that they were looking at the top set of links, focussing on the first four. In addition, when they opened links they tended not to search within the page (or indeed, effectively scan the text for key phrases) – for example, while searching for question 5/6 regarding the footballer Stanley Matthews the answer appeared on a number of the pages and search results they opened, but because it was not immediately obvious, they missed this information.

Table 5 – Summary of epistemic content of Group 1's activity

'Dimension'	Commentary
Simplicity	Mid-level; the group think detail is useful, and make some connections between information, but show no awareness that other information could also be added or connected into the picture instead suggesting all the pertinent information has been found.
Certainty	Mid-level; the group checks temporal location of information (i.e., when things happened) indicating an awareness of change.
Source	Mid-level; the group has a reliance on the Nobel Prize website, an authoritative source (as opposed to popular or well known – both lower level)
Justification	Lower-level; unclear behaviour here, but their use of search results to scan for repetition and key phrases may indicate that 'repetition' of information is an indicator of truth as could 'detail' be.

Group 2.

While Group 2 was the most 'successful', they also engaged in a lot of 'off task' behaviours. In addition they engaged in a number of poor search strategies (as below). This group tended to answer the 'part b' questions – regarding how they knew the information they had found was useful – with reference to the information being 'new' to them, or looking good (aesthetic value),

as opposed to being 'key' information to know – which more closely describes Group 1's justification. For example, the part 'b' of question four was answered "because we didn't know he had another name", and of question two "because we found lots of new things out" – and talk indicated this focus on novelty too, as in Table 7. However, they were also interested in the authoritativeness of the information, for example to question one writing "because it answered the question and is the official Nobel Prize website", to three "because the website is a reliable one", and to seven "because many sights [sic] agree". Interestingly, they also had a misunderstanding regarding the nature of 'copyright' which may be significant in understanding how they engage information literacy – in answering questions five/six, which involved finding a photo of Stanley Matthews, they suggested the information was useful because "it's copyright", also noting that there were many photos of the same thing. These factors suggest a view of knowledge which relates to authority, novelty, and reliability (or repetition) – in contrast to Group 1's, which seemed more focused on detail, and connectedness.

Table 6 – Cohesive Ties in Group 2's talk

Section	Tie	Examples	Commentary
Q1	"How many"	"How many women have…"	Very tight focus on the question asked.
Q1b	"who is she"/"she is"	"Who is Marie Curie", "Marie Curie is a scientist"	The 'why is she famous' q. is asked a number of times, but generally ignored in favour of fact collection ('who is').
Q2	"why is she famous"	"Why is she famous"	
Q2b	"I didn't know"	"I never really knew what she did"	
Q3	"he stood up/stuck up"	"he stood up for what he believed in"	
Q4b	"I didn't know"	"I didn't know he had another name"	Tie to Q1b

Despite this apparent appeal to authority, including a use of the Nobel Prize website, and the addition of 'BBC' to a number of their search queries (presumably to bring up 'reliable' BBC based websites), when these strategies failed to yield results, their alternatives were variable. For example, they moved from searching for "what makes Nelson Mandela a good role model?" – a variation of the question asked, indicating a fairly static and simplistic view of knowledge regarding role models – and moved from a very brief look at a site called 'notenoughgood.com[3]' (4th result), back to the results page, ignoring the wiki answers site, to click on a Guardian result[4]. Unlike Group 3, they simply scanned this result and used it as part of a synthesised answer. However, it is interesting that in their talk they did note the importance of Mandela's geographical, and historical context – that he had "stuck up for" his beliefs at a time, and place of significance. As Group 1, Group 2 tended not to read returned results, or opened sites in detail, as indicated above in the search example on Stanley Matthews. Interestingly, they correctly pointed out that a photo (of Matthews' statue) could have been edited ("photoshopped"), but given the context this was an unlikely suggestion. Similarly, their reasons for supposing the source was accurate related to the repetition of the photo on a number of websites, as opposed to creditability of the source, or relatedness to the question and the connected knowledge provided. Part of their justification for the quality of knowledge in this instance was that the photo was copyrighted – an interesting appeal to authority, which indicates an awareness of the legal standing of '©' but without an understanding of its significance. This raises a potential concern regarding belief of claims on various websites which would maintain copyright, but not be considered reliable sources.

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[3] http://notenoughgood.com/2011/07/nelson-mandela-and-youth/
[4] http://www.guardian.co.uk/commentisfree/2008/oct/14/blackhistorymonth-nelsonmandela

Although this group did progress to the final two questions (self-directed search), their response was shallow, using 'mums' as their chosen role model, thus avoiding the need to research[5]. They did, however, engage in some valuable discussion regarding cookery skills in the genders, giving good counter examples (Gordon Ramsey, Michelin chefs), although they failed to capitalise on this talk for research, resorting to more personal knowledge claims.

Table 7 – Summary of epistemic content of Group 2's activity

Dimension	Commentary
Simplicity	Lower-level; the group emphasise authority, novelty, and directly answering the specific question as reasons for importance.
Certainty	Mid-level; they check some facts, but tend not to explore complexities of 'role model' in any questions indicating a more 'absolute' view of knowledge.
Source	Mid-level; the group has a preference for BBC information, and has some understanding of why 'answers' sites might be problematic (i.e. they have a hierarchy of authoritativeness).
Justification	Lower-level; the group focuses on authority as a source of knowledge.

Group 3.

Group three was particularly distracted by the suggested search function. Having selected the official website for the Nobel Prize, they failed to spot the answer immediately, instead scrolling up and down the winners and attempting to count them. They then returned to Google and opened another nobelprize.org page (heroines of peace - specifically on the Nobel Peace Prize). Again failing to see an answer on this page they returned to Google to enter the query "how many people in total have won the Nobel Peace Prize".

After a quick look at those results, they returned to the nobelprize.org site and used the internal site-search function (demonstrating some awareness of website structure) to search for "how many women have won the Nobel Peace Prize since the prize first started". A feature of this

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[5] We should note that this was also very common amongst pupils in the first school who were asked to complete these two questions for homework. Pupils in this lesson were, however, specifically asked to choose someone they would need to research, and to avoid some of the usual selection – footballers, celebrities, etc. and indeed the teacher in this case did request that the group select an alternative role model to research.

search function is keyword highlighting on returned excerpts – i.e., the terms used are highlighted in the results which provide a preview of their contained text; however, unfortunately in this case the search was too specific to return any useful results. After some flitting back and forth between Google and the Nobel Prize website, they moved on to searching for 'Marie Curie'. This activity is reflected both in the lack of on-task talk – of a constructive nature or otherwise – and the ways in which on-task talk is structured, mostly lacking cohesion, and often confused even around the language offered in the questions themselves, as Table 8 indicates.

Table 8 – Cohesive Ties in Group 3's talk

Section	Tie	Examples	Commentary
Q1	"Nobel Prize"/"Nobel Peace Prize"	"Basically it's the Nobel Peace Prize"	Although they do mention 'how many women' their linguistic focus is on the Nobel Prize – and moreover, the Nobel Peace Prize.
Q1	"how many"	"How many women"	
Q1	Numbers (particularly 'one') "one in" and "___ one" (e.g. 'literature, different, that one, etc.).	"Do one from each", "I want one in 2011"	Focus on listing items, as many as will fit in the box.
Q1	"Nobel Peace Prize" and "how many"	[teacher] "So how many women have won it then, in total?" "how many have been awarded?"	The teacher checks how they're doing and clarifies the question requirement (the number – 'how many'), this highlights the phrase to them.
Q2	"she was"/"she has"	"she was born", "she has her own charity"	

The group's failure to critically interrogate sources would seem to reflect a rather simplistic view of knowledge as information which may come from anywhere (i.e. the specific source does not matter too much). They connect some prior knowledge to the questions – specifically regarding

the Nobel Peace Prize, and the Marie Curie charity. However, in the first case they spent a substantial time focussed on the *Peace* prize, and did not broaden their frame of reference to explore the more general prizes, failing to connect these pieces of information. Correspondingly in the latter case they did not connect their prior knowledge (regarding the Marie Curie charity) to the person Marie Curie and her work. Similarly, this group appropriately noted that it might be interesting to investigate the fields that women have won prizes in, when the prizes were awarded and so on. However, the group appeared to treat each of these tokens as discrete pieces of knowledge, rather than thinking of them in the context of a wider picture (for example in 'part b' of question 1, offering a listing: "because it says when the women were awarded, what there [sic] name and the subject the studied to win the Nobel Prize"). This apparently simple perspective on knowledge is repeated in each answer to why information is useful, in which the group reflects on the presence of 'facts' and 'information' without critiquing these, or in some cases filtering them – for example, including information regarding the number of grandchildren Nelson Mandela has in a question asking about his status as a role model.

This group tended to answer the 'part b' questions – regarding how they knew the information they had found was useful – with reference to the *presence* of information emphasising quantity and aesthetic value. This is in contrast to Group 1 who emphasised detail and information's 'importance'. For example in 'part b' of question 2 Group 3 wrote: "It had loads of explained facts and information which were very catchy points". In a similar vein, they appear to be justifying their knowledge claims in 'part b' of question 3 with regard to repetition across sites writing that they "found the information then looked on another website an [sic] we got the same information" without critical appraisal of either site.

Indeed, in this instance they had searched for "why do some people think Nelson Mandela is a good role model", opening two 'answers' style sites (wiki and yahoo). Without much consideration of these sites, they spent some time off-task, before opening the same Guardian article Group 2 encountered and taking quotes from this without considering the justifications for those quotes - e.g., he was a symbol of "strength" but not why that might have been the case. While the use of the more authoritative Guardian website may be viewed positively, their attempt at directly quoting (inaccurately) from this opinion piece indicates a poor understanding of the justification of such claims as being about more than just assertion. This activity also implicates a simplistic view of knowledge, as being based on belief rather than being grounded in facts. They again got distracted at this point (by filling in a form), and returned to Google, opening an (irrelevant) Daily Mail article, before returning to a Wiki Answers page (the answer for which related to Mandela's divorce, as opposed to his political struggle).

They then opened a 'Wisegeek' link, with some general information on him (including another name for him – 'Madeb'). While the Wisegeek information was of reasonable quality, it was accompanied by anonymous comments underneath. These comments provide some interesting perspective on the risks of such comment areas; while certainly Mandela isn't uncontroversial (which is partly why he was included in the task), decontextualised critique is unhelpful and likely to be confusing to pupils (although in this case it appears to have been ignored). After some reading, the group returned to Google and to the last hit on the first page – a personal University-hosted page from an American college student[6]. Again, the group engaged in no critique of this source, although their use of this address (mtholyoke) in answer to the 'source' of the information may indicate their belief that this was the best of the sources they had encountered.

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[6] http://www.mtholyoke.edu/~gardn20a/classweb/earlylife.html

Table 9 – Summary of epistemic content of Group 3's activity

Dimension	Commentary
Simplicity	Lower-level; the group emphasise quantity, and fail to distinguish useful from non-useful (but connected) information.
Certainty	Lower-level; the group engages in no analysis of the context of information – either geographically or temporally – nor do they engage in any discussion regarding whether the individuals are good role models, simply writing 'yes' in each case.
Source	Lower-level; the group seems not to distinguish between different sources. While other groups used 'answers' style sites, they generally used these alongside more authoritative sites (i.e., they had some form of hierarchy). Group 3's flitting between the Nobel Prize site and 'answers' sites at the start, for example, indicates that such a hierarchy was not salient for them.
Justification	Lower-level; the group noted agreement with other sources as significant for justifying knowledge claims, however in most cases they engaged in no critique of either information presented as 'fact', or opinion pieces (e.g. the Guardian piece). This indicates a rather simplistic view of knowledge as 'belief'.

Discussion

The reported study provides support for the claims that:

1) IS tasks are well suited to drawing out epistemic actions, and talk which embodies participants' epistemic perspectives;

2) That epistemic actions can be considered in their collaborative, task-oriented context;

3) That success in IS tasks is, in part, related to the type and quality of epistemic talk occurring in collaborative groups.

We will first outline these claims in more detail, before going on to offer some criticisms of the present research, and propose some areas for further research.

A key finding of the paper is that, where appropriately constructed, IS tasks are well suited to drawing out children's epistemic actions and talk which embodies their epistemic perspectives . As we see from the analysis of the talk data, and the worksheet answers (from the whole class), epistemic language can be identified in response to all of the question types used. Given that

some of the questions (the 'part b' elements) specifically requested consideration of the source quality, this may seem unsurprising. However, it is important to note that the groups answered these questions in rather different ways – their behaviour, and the talk they engaged in indicated particular epistemic perspectives, which were co-constructed through their collaborative talk. This analysis of epistemic talk as a facet of collaborative activity has – to our knowledge – not been explored before. The analysis provided here, particularly in the context of IS tasks, suggests a fruitful method for future research to use. Given the value of collaborative dialogue in educational contexts, the findings reported in this paper also suggest the need for research and interventions in effective dialogue around information seeking and processing tasks. The problems experienced by the groups while they engaged in search are not unusual. Despite the increasing prevalence of, and familiarity with the internet and search engines, people – particularly children – struggle to find and evaluate information. In schools it may be appropriate to explore technological solutions to encourage more critical use of search throughout the IS process. More broadly, this research highlights the value of effective dialogue for pursuing such tasks, and thus interventions which focus on the development of children's skills in using dialogue may be particularly fruitful (Littleton & Mercer, 2013).

In the discursive approach adopted here, we recognise that the properties of the discourse identified are in a sense co-created by the situation from which they arise; in this case, a particular classroom context, 'grounding' introduction, and 'scripting' worksheet – which may lead to longer, and more structured responses (Schoonenboom, 2008). Thus, while this method is a useful prompt for encouraging particular types of talk – and response – in group activity, and indeed it reflects a naturalistic classroom task, the validity of observations made outside of the context of such tasks may be called into question.

Furthermore, we note that although the observed lesson was directed by the teacher, the use of a standardised lesson plan guided by a PowerPoint provided by the researchers imposed a degree of 'control' over the teacher's epistemic cognitions and beliefs, which may have impacted on classroom discourse and pupils' behaviour (Maggioni & Parkinson, 2008). With regard to the small number of tasks and topics probed, this is certainly an area for further research. A concern related to this is, of course, that the prior knowledge of the pupils may affect results (Fidel et al., 1999). However, in this study although there was some evidence that some pupils in the class had heard of some of the material before – and one pupil in particular (who was not in our observed groups) had an extensive knowledge of Nelson Mandela – this was not widespread, and the analysis of the discourse in our groups did not reveal any extensive prior knowledge.

A final concern with our design may be that by not controlling or analysing the assignment of pupils to groups, a level of data (and potential bias) is lost. This is certainly a valid concern, but for practical reasons there was no alternative, given that neither the researchers nor the teacher was familiar with the pupils. Of course, in this context it is also worth noting that the object of analysis *was* the dynamic way in which pupils used group-talk to structure their activity, and co-construction of meaning in the context of the IS tasks; this in a sense *is* the group dynamic – the way the pupils work together to make sense of their social, and academic setting.

Furthermore, the analysis of worksheets from a pilot study indicated slightly lower levels of completion (commensurate with a shorter lesson time), and similar, epistemic, comments to questions regarding the "use" of information – appeals to authority ("Because it's the BBC"), failure to assert utility of one fact over another ("we don't know if it's useful"), or to do so in a highly uncritical way ("because it has the right facts"), alongside answers regarding relevant

detail ("it tells us why and how she got famous"), and novelty ("*now* we know how many women have won a Nobel prize").

The importance of understanding student IS is highlighted by the fact that teachers are increasingly unlikely to direct students to just one or two books; and while they may direct them to some appropriate websites, it is both unlikely that students will restrict themselves to these, and undesirable (from the perspective of developing students' skills in gathering and critiquing information) that they should do so. Understanding the relationship between epistemic discourse, task success and tool use is thus crucially important for the effective educational use of information-seeking technologies in the classroom.

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