An investigation of factors marginalising the Bildung goals of the Swedish gymnasium curriculum in chemistry teacher’s reports of their teaching

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Abstract

Background. Bildung (in Swedish bildning), has historical relevance for the Swedish education system and remains a crucial element of the Swedish school curriculum today. Significantly, economic goals also inform the content and form of the curriculum with research findings suggesting that these goals dominate over, or marginalise the curriculum’s humanistic or Bildung goals. Since evidence suggests that both Bildung and Bildung-related capacities may have crucial importance in terms of the level of meaningfulness individuals experience in relation to the knowledge they learn and the contribution they are able to make in the promotion of healthy democratic societies, such a marginalisation may represent a significant risk to pupil’s (and society’s) health. A question of relevance to educational research therefore is in what aspect, if any, do economic goals, as manifested within the Swedish school education system, marginalise the curriculum’s humanistic or Bildung goals in gymnasium school teaching? Method. Three chemistry teachers were recruited from gymnasium schools in Southern Sweden and interviewed using a semi-structured interview developed by the author. Developed in two parts, the interview sought first to garner teacher’s vision for their teaching. The second part sought to garner information related to the choices teachers make in order to realise their vision for their teaching. Analysis. In total six unique theoretical perspectives related to ‘Bildung’ and two perspectives related to ‘an economically-driven view of education’ were used to identify content in the interview transcripts that was consistent with these two themes. The incidence of and relationship between the themes was then evaluated for all three transcripts. Common trends amongst the three interviews were also identified. Results. The study’s results show that economic goals in the form of external contextual factors impact the working realities of all three participating teachers so that Bildung-related dimensions found in their respective visions for their teaching become marginalised. In addition, ‘implicit’ factors, that is, factors particular to the teachers themselves that are outside of their awareness, marginalise Bildung by limiting teacher’s potential for engagement in a Bildung-related didactic praxis. Implications. The major implication of this work is that this result represents a call for higher educational institutions to more deliberately foster a Bildung-related didactic praxis in trainee chemistry teachers, something which in our view is most powerfully achieved through teacher training itself being grounded upon a Bildung-related didactic praxis.
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1. Introduction

The Swedish construct ‘bildning’ is in its meaning closely linked to the late 18th century German construct Bildung (Burman, 2014). ‘Bildning’, or Bildung, has historical relevance for the Swedish education system and remains a crucial element of the Swedish school curriculum today (Burman, 2014). Although appearing explicitly only a single time in the curriculum for gymnasium schools, there are numerous passages in parts 1 and 2 of the curriculum that appear to be consistent with Bildung as a way of thinking. Thus, the curriculum’s opening section, which seeks to lay out the core values of Swedish gymnasium schooling, includes the following passage which can be understood as encompassing the full meaning of Bildung: “Skolans uppgift är att låta varje enskild elev finna sin unika egenart och därigenom kunna delta i samhällslivet genom att ge sitt bästa i ansvarig frihet” (Skolverket, 2011, p5). In addition, several other passages touch on ideas related to Bildung. Most significant of these are those concerned with the different capabilities gymnasium schools have the responsibility of developing in pupils. Examples include the ability to think critically, to understand the relativity of knowledge and have reflective capacity; and to have knowledge about one’s own strengths/capabilities (Skolverket, 2011).

Significantly, Bildung is not alone in being an influencing factor regarding the Swedish gymnasium curriculum, and there are several elements underlying the curriculum’s content and form (Adolfsson, 2013). According to Gustavsson (2009) the different sources of influence manifest as three clear dimensions: Goals that serve Swedish and EU economic interests, goals that serve the interests of sustaining a democratic society, and goals that are humanistic and which can be described as Bildung goals. Crucially important here is that the three dimensions are viewed as being incompatible, resulting in a curriculum that contains considerable tensions (Adolfsson, 2013).

Of greater significance than the incompatibilities themselves however are research findings suggesting that economic goals dominate over, or marginalise the curriculum’s democratic and humanistic goals (Lundgren, 2011; Sundberg & Wahlström, 2012; Adolfsson, 2013). Gustavsson (2009) for example discusses the marginalisation of Bildung in terms of an

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1 For the proceeding work I will exclusively use the German Bildung. On occasion however I will need to refer to the Swedish bildning.
education system in which knowledge is increasingly viewed as something specifiable, packageable, measurable and deliverable to the minds of pupils\(^2\), and he warns that the curriculum’s humanistic or Bildung goals are at risk of becoming devalued, both at the level of policy and in teacher’s teaching.

The possibility that economic goals, as manifested within the Swedish school education system, marginalise the curriculum’s humanistic or Bildung goals is a matter of significant importance to educationalists since any such marginalisation could have significant consequences for pupil’s learning. Avery & Wihlborg (2013) for example claim that learning becomes fragmented and instrumental rather than personally meaningful as a result of Bildung becoming marginalised in higher education. Further, important Bildung-related goals, such as the development of critical thinking and reflective capacity, may become neglected in an educational system dominated by a need to quantify learning (ibid). Significantly, the development in pupils of critical thinking and reflective capacity are two Bildung-related goals found in the Swedish gymnasium curriculum as well. Should the development one or both of these capacities be neglected in teacher’s teaching the impact upon pupils may be significant. For example university student’s critical thinking is positively associated with their individual values (Nalcaci, 2012), social and emotional learning (Arslan & Demirtas, 2016), and ability to avoid cognitive biases (West et al., 2008). Also, reflective capacity may be crucial in enabling democratic forms of communication (Cohen 1999, Whipple 2005, Bohlin, 2014).

A question of relevance to educational research therefore is in what aspect, if any, do economic goals, as manifested within the Swedish school education system, marginalise the curriculum’s humanistic or Bildung goals in gymnasium school teaching? As a student chemistry teacher it is of particular interest to ask this question with regard to chemistry teaching in gymnasium schools. Further, in the context of this work being a student thesis, it is with regard to chemistry teacher’s reports about their chemistry teaching that this question may be most reasonably empirically explored.

\(^2\) Such a view of knowledge is central to being able to view education as an effectivisable process with regard to the production of people with the competencies needed for work (Gustavsson, 2009)
2. Justification for and purpose of the study

The justification for this study is that there is a perception that the Swedish curriculum’s humanistic or Bildung goals are marginalised by the impact economic goals have within the Swedish school education system, this despite Bildung being linked with cognitive and social-emotional outcomes of importance to both pupil’s and society’s healthy development. The purpose of this study is to investigate the following research question: In what aspect, if any, economic goals, as manifested within the Swedish school education system, marginalise the curriculum’s humanistic or Bildung goals in chemistry teacher’s (reports of their) chemistry teaching.

3. Theoretical perspectives

In this section a number of theoretical perspectives valuable to the answering of this study’s research question are described.

3.1 Theories of Bildung and human growth

3.1.1 Conceptualisations of Bildung and human growth

The origins of Bildung as a construct lie in the 13th century, its meaning having then theological and spiritual significance (Sjöström et al., 2017). By the 18th century the meaning of Bildung had shifted to being associated with the ‘liberation of the mind’ (Eldritch, 2004). Three German philosophers/educationalists in particular are associated with the development and use of the construct from this period: Johann Gottfried von Herder, Wilhelm von Humboldt and Friedrich Hegel. During the 19th century the American philosopher John Dewey, although developing his philosophy of education along a different tradition of thought to that of German Bildung theorists, developed a construct called ‘growth’ that can be viewed as having important connections to Bildung (Kivelä et al., 2012). More recently German educationalist Wolfgang Klafki (1927-2016) has developed the Bildung construct by placing it at the center of his theory of didactic analysis (Vasquez-Levy, 2002; Klafki 2000a; Klafki, 2000b). Of particular importance to this study
are Dewey’s and Klafki’s perspectives on Bildung and human growth. Table 1 summarises these scholars viewpoints.

Table 1. Conceptualisations of Bildung and human growth

<table>
<thead>
<tr>
<th>Educationalist</th>
<th>Understanding of Bildung</th>
</tr>
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<tbody>
<tr>
<td>John Dewey (1859-1952)</td>
<td>A process of self-directed inquiry brought about by the individual having a need of creating new ways of thinking and doing in order to navigate a problematic situation (Juuso, 2012). Collaborative democratic communication as a crucial antecedent of the individual’s engagement in inquiry as a reflective activity (ibid). The pupil’s phenomenological experiences as the point of departure for learning (Väkevä, 2012).</td>
</tr>
</tbody>
</table>
| Wolfgang Klafki (1927-2016) | • The self-driven individual preoccupied with his or her moral self-formation and improvement (Klafki, 2000a).  
• Bildung as promoted through the individual’s encountering of ‘cultural assets’ that have the power to confer some aspect of self-formation (ibid).  
• Bildung as involving dimensions in which ideas of individuality and communality are bound to one another, e.g. the individual’s self-determination is conferred through his or her relationships to others.  
• Bildung as involving moral, cognitive, aesthetic, and practical dimensions (ibid). |

3.1.2. The Swedish ‘bildning’ construct

According to Lindskog (2007), the Swedish construct ‘bildning’ as it is used today can have multiple meanings. In his text analysis of documentation connected to Swedish higher education the author found twelve dimensions being used in connection with the construct (ibid). Despite Lindskog’s analysis suggesting a multiplicity of meanings in the construct’s contemporary usage, texts written by contemporary ‘bildning’-scholars support a narrower understanding of it, as well as a view of it as being closely aligned to German construct Bildung (Burman, 2014). Table 2 summarises the viewpoints of Bernt Gustavsson (1946-) and Henrik Bohlin³ (1961-).

3.2. Promoting Bildung as the goal of didactics

Among contemporary educationalists, Wolfgang Klafki is perhaps the most prominent in describing a Bildung-centred didactic theory (Vasquez-Levy, 2002). Central to Klafki’s didactic approach is the teacher being required to critically examine the curriculum/course

³ Bohlin draws from transformational learning theory in his conceptualisation of ‘bildning’.
syllabi with a view to revealing ‘contents of education’, that is, specific content within the curriculum/course syllabi that can be objectively viewed as causing Bildung (Vasquez-Levy, 2002; Klafki 2000a; Klafki, 2000b; Hopmann, 2000). Of central importance here is that the teacher has a ‘profound comprehension of content’, which implies an understanding of content that goes far beyond a superficial understanding of concepts presented in textbooks, and which allows the teacher to grasp deeper dimensions of a subject that the teacher views as being important to the pupil’s self-formation (Vasquez-Levy, 2002). A crucial aspect here is the teacher’s ability to recognise the transformative power of certain elements of the subject matter to be acquired (Vasquez-Levy, 2002; Klafki, 2000b). Klafki uses the term ‘educational substance’ when describing particular examples drawn from a subject matter that confer in the minds of pupils an understanding of universal truths⁴ (Klafki, 2000b). If the teacher is to discern transformative ‘educational substance’ it is not sufficient however that they work only to identify ‘contents of education’. Crucial here is that their identification of ‘transformative’ elements takes into account both pupil’s phenomenological reality as well as their own vision of the kind of responsible citizens he or she believes the pupil’s must become (Vasquez-Levy, 2002; Klafki, 2000b; Hopmann, 2000).

⁴ From a Bildung perspective ‘universal truths’ should be seen as ways of thinking and doing that confer on pupils greater autonomy through laying the foundations for their developing of deeper relationships to different aspects of their world (Vasquez-Levy, 2002).
3.3. Educational research focussed on Bildung in chemistry teaching

Sjöström views contemporary society from a perspective of risk in which rapid technological and scientific advancements generate products whose social, cultural and environmental consequences are unpredictable (2013). A crucial need in Sjöström’s view are reflectively aware, action-oriented, democratically engaged citizens, who, armed with a proactive humanist- and environmentalist-centered approach to human living, are able to take a position of critical and reflective distance regarding science as well as its scientific and technological inventions, and through doing so problematise their existence, benefit, and risk to people, society and the environment (ibid). As a chemist and educationalist, Sjöström’s vision is of chemistry teaching as a transformative practice with the ideas of Bildung at the heart of the subject’s power to transform and prepare pupils for capable and proactive participation in “coping with the transformation of the modern risk society in the direction of global sustainability” (Sjöström et al., 2016, p325).

Drawing from scholarly works in science and chemistry education, Sjöström has developed a three-level model describing three approaches to chemistry teaching that embody a ‘human element’ (Sjöström, 2013). In drawing from science and chemistry educational research Sjöström’s model is powerfully informed by research concerned with the promotion of ‘scientific literacy’ and ‘chemical literacy’ in science and chemistry education. The Organisation for Economic Co-operation and Development (OECD) define scientific literacy as: “The capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and change made to it through human activity” (Cited in Eilks et al., 2013, p2). Regarding the term chemical literacy, there is, according to Shwartz et al., no single agreed upon definition. In the authors view however chemical literacy should “enable students to understand the role of chemistry in their life, in society and to become able to participate in societal debates about developments connected to science and technology” (2013, p38). Consistent amongst these two definitions is a view of the person as having a well developed knowledge of science (or chemistry) who also has a knowledge about science (or chemistry), and who as a consequence of this has a reflective awareness related to science (or
chemistry), its products/technologies, as well as the relationship between science (or chemistry) and society and the environment.

Returning to Sjöström’s three level model, one can see that one crucial difference between the three different approaches to chemistry teaching defined in the model is the breadth and nature of themes related to chemistry as a subject that a pupil has developed a reflective awareness for. At the lowest level, which Sjöström defines as ‘applied chemistry’, is a chemistry teaching that promotes a reflective awareness for the applications of chemistry that the pupil is likely to come into contact with, both in their day to day lives and in other contexts, such as through the media (2013). Here reflective awareness development does not proceed beyond a matter of fact acceptance that these products exist in the pupil’s world and that they are related to the subject of chemistry. At the intermediate level, which Sjöström calls ‘Socio-cultural context’, is a chemistry teaching that enables pupils to develop a reflective awareness for (or reflective distance towards) the subject of chemistry itself by developing a view of the subject (and science) as it is embedded in its historical and contemporary context (ibid). At the highest level is Sjöström’s ‘critical-philosophical approach’ which also corresponds to a Bildung-oriented chemistry teaching (ibid). Here the pupil’s reflective awareness regarding chemistry broadens to include an awareness for ethical and philosophical dimensions of chemistry, as both a body of knowledge and an industry embedded within a social, political, cultural and environmental context (ibid). A crucial tool here in promoting this degree of reflective awareness is a critical questioning approach (ibid). Importantly, and separating the bildung-oriented approach from the two previous approaches, is that teaching not only promotes pupil’s reflective awareness, but also, by bringing into awareness ethical dimensions as related to chemistry and its existence in wider social, political, cultural and environmental milieus, Bildung-oriented teaching engages pupils at an emotional level, giving pupils impetus to employing their reflective distance regarding chemistry in responsible societal and environmental endeavours (ibid).

3.4. Education as seen within an economic paradigm

Within an economic paradigm education is viewed as an arena for state control of the population, the ultimate purpose of which is its profitable utilisation in the interests of the state’s survival and prosperity through economic growth (Adolfsson, 2013; Englund, 2005). Economic growth in a contemporary sense involves the state increasing its competitive
advantage in the production and export of goods in a global market economy (Sundberg & Wahlström, 2012). Importantly the state is able to achieve its aims by framing education as a pathway to independent economic growth for the individual. The individual therefore ‘buys’ into an economic view of education himself (Adolfsson, 2013).

A crucial aspect of generating competitive advantage for the state through education is the effectivised production of ‘human capital’, that is, a cost-, time- and results-effectivised production of people with the competencies needed for work (Adolfsson, 2013; Englund, 2005; Sundberg & Wahlström, 2012). So that such an effectivised production may be achieved, the state must exercise greater control over the didactic what- and how-questions, that is, the content and methods of teaching (Sundberg & Wahlström, 2012). Equally crucial is that the performance of educational institutions is continually evaluated by the state in terms of their results and outcomes (ibid). Of importance here, and so that the consistent measuring of performance and control of quality across educational institutions is at all possible, is that the knowledge pupils are obliged to learn follows standard requirements and the level of their attainment of that knowledge is reliably measured using suitably aligned criteria (ibid).

Importantly, the European Union has become an important steering force in education across Europe (ibid). Indeed, the EU’s overarching aim is to become “the most competitive and dynamic knowledge-based economy in the world” (Presidency conclusions (2000), Cited in Sundberg & Wahlström, 2012, p346). Crucial to realising such an aim according to Sundberg & Wahlström (2012) is the EU’s work to promote the creation of educational systems within the union that are leaders in the production of human capital. A vital tool that the EU uses in this respect in order to drive improvements in performance across the union is the Programme for International Student Assessment (PISA) (Lundgren, 2011; Sundberg & Wahlström, 2012).

5 According to Sundberg & Wahlström (2012) the Swedish national curriculum of 2011 is a standards-based curriculum.

6 PISA is a worldwide study that assesses reading, writing and mathematical skills in pupils age 15.
3.5. McGilchrist’s divided brain hypothesis

In his book *The Master and his Emissary*, psychiatrist and former Oxford literary scholar Iain McGilchrist describes the two hemispheres of the human brain as giving rise to two seemingly opposing ‘personalities’ (2009). The first, that of the left hemisphere, is *mastery focused* and primarily concerned with representing the world in order that it might gain mastery and power over it. Human being’s tool building is an example of such a mastery focus (ibid). The second personality, that of the right hemisphere, is *relationship focused* and is primarily concerned with being in a relationship ‘to that which itself is not’ (ibid). Being in a relationship to God, nature, other people are all examples of relationship focussing. In his book, McGilchrist suggests that the right hemisphere should have primacy (ibid). However, the author claims that since the Enlightenment the left hemisphere has taken for itself the role of primacy and as a result dominates over the right hemisphere using the Corpus callosum to inhibit the right (ibid).

Importantly, and of relevance to this study, McGilchrist’s hypothesis regarding the existence of two fundamental pathways of hemispheric brain activation reveals two divergent motives that human beings have for learning. From a perspective of McGilchrist’s right hemisphere primacy the motive driving learning is a wish to be in a relationship with different aspects of the world and be renewed through those relationships. The ultimate motive for learning from this perspective therefore is growth. Significantly, McGilchrist’s right hemisphere primacy as a mechanism of brain activation is consistent with ideas related to *Bildung*. For example, it is consistent with Gustavsson’s understanding of *Bildung* as a process of personal renewal resulting from repeated excursions of ‘journey and return’. It is also consistent with Bohlin’s understanding of *Bildung* in that *Bildung* is facilitated through the individual pursuing self-renewal through coming into contact with new ways of thinking and doing.

From a perspective of McGilchrist’s left hemisphere primacy the motive driving learning is a wish to understand the world in a manner that can allow one to gain greater mastery and power in it. The ultimate motive for learning from this perspective is survival and self-preservation. Importantly, McGilchrist’s left hemisphere primacy as a mechanism of brain activation is consistent with education as seen within an economic paradigm.
4. Method

4.1. Participants

Three chemistry teachers were recruited from gymnasium schools in Southern Sweden. Sampling was made on the basis of the author contacting chemistry teachers at different gymnasium schools and teachers showing an interest in taking part in the study. The single criterion for participation was that teachers had significant experience in teaching chemistry in Swedish gymnasium schools.

4.2. Choice of research method

The choice of research method for this study is a semi-structured interview. There are a number of reasons why this is the method of choice. Ideally, the research question this study seeks to answer should be investigated at the level of the teacher’s teaching. Pursuing such an aim however is not realistic in the context of a student teacher study since one would almost certainly need to follow research subjects over an extended period of time. Thus, within the context of the prevalent time constraints, the most suitable research approach is to gather information from research subjects via interview or questionnaire. Of importance when selecting the most appropriate method for gathering information in this respect is the degree of confidence one has in one’s interview or questionnaire questions regarding their potency for yielding the information that can answer the research question(s). Since this study represents the first time that a research question of this nature is being pursued empirically, it would be ill-advised to use a structured interview or questionnaire. The risk is too great therefore that the questions asked in a structured interview or questionnaire would fail to yield answers that allow the answering of the research question. A semi-structured interview is therefore the most appropriate method for this study. This because it allows the interviewer to explore with the interviewee aspects relevant for the research question that the interviewer might not have thought about prior to the interview.

Crucial to reflect upon in this respect however is that a semi-structured interview is a qualitative research method. Significantly, this study is concerned with discovering evidence for the purpose of further arguing for a particular ‘truth’. The research question is inconsistent therefore with the relativist epistemological position underlying qualitative
research (see for example Couvalis, 1997). Importantly however, there are elements of this study which are consistent with an interpretative approach. For example, spontaneous follow-up questions asked by the interviewer during the interviews will be based on the interviewer’s interpretation of the interviewees answers ‘in the moment’. Also, the interviews, once transcribed, will be analysed using the different theoretical perspectives presented in the introduction of this work, many of which concern constructs that are broad, multifaceted and not simply defined. Consequently, the proposed research strategy should be viewed as containing both objectivist and relativist elements.

That this is the case has important consequences for how this study is executed. Firstly, the objectivist aspects of the study require that one of the study’s core empirical concerns is the garnering of information that is truthful and valid. Such a demand raises however questions concerning how much detail can be shared with participants regarding the aims of the study prior to their being interviewed. This is because having knowledge of the research questions risks influencing interviewee’s in their answering of the interview questions. For example participants with knowledge of the research question may respond by attempting to behave in a ‘correct’ way (see for example Shaughnessy et al, 2009), that is, by shaping their answers so that the impression given is that they work to realise all of the goals of the curriculum, Bildung goals included. Alternatively, participants might respond by seeking to be ‘good research participants’ (ibid), that is, they may shape their answers that confirm what it is the researcher wishes to find. Importantly, the truthfulness of participants answers is crucial to the validity of the answers the study yields regarding the research questions.

A second consequence of this study having both objectivist and relativist elements is that the external validity of the study’s findings will be limited by its relativist aspects. In other words, generalising the study’s findings beyond the three participating research subjects is controversial. External validity however is not the only aspect of the study that is influenced by the study using a semi-structured interview. The interviewer’s use of interpretation in formulating follow-up questions during interviews means that the study’s reliability is also affected, that is, the interviewees narratives would likely be different should each of the interviews be repeated. Moreover, should the research subjects have been interviewed by

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7 According to Bryman research strategies are often more ‘free floating’ in terms of their epistemological positions than what is normally believed (2002).
someone other than the author, there is a significant chance that subject’s narratives would be different in important ways. What is most important in this regard however is that the specific distinctions that are drawn from the interviews are distinctions that can aid the answering of the research question. Clearly, providing interviewee’s narratives are truthful, then issues regarding reliability are only of relevance should the interview narratives fail to contain distinctions that can aid the answering of the research question.

4.3. Materials

An interview guide was developed by the author. The interview guide was structured in two parts; the first part being concerned with garnering information related to teacher’s vision for their teaching, both in general terms, and as chemistry teachers, and the second part being concerned with asking teachers to describe, giving also examples, their work to realise their vision for their teaching; that is, to provide a description of the didactic choices they make in their teaching. A working hypothesis of the author in this regard was that Bildung goals, if a teacher were to identify with them, might be more consistently represented at the level of a teacher’s vision for their teaching than at the level of their reported work to realise their vision. A second working hypothesis was that should a situation arise in which a teacher is faced with a disparity existing between their vision for their teaching and their work to realise their vision, then, if prompted to give reasons for the disparity existing, they may be inclined to make overt statements in which they justify a need to prioritise the pursuit of activities that reflect the manifestation of economic goals.

In addition to seeking to reveal a potential discrepancy between teachers’ vision for their teaching and their reported activities to realise that vision, the questions in the interview guide needed also to be able to focus teacher’s narratives on the two core themes of the study, that is, economic goals, as manifested within the Swedish school education system, and Bildung. A core didactic question that can focus the narrative onto these core themes is ‘What content should pupils learn?’. Significantly, there are important links between this question and teacher's work to promote Bildung, e.g. Klafki’s approach to didactic analysis. One would expect therefore for such a question to open the possibility for participants to fill their narratives with content consistent with Bildung.
In addition to asking research subjects ‘What content should pupils learn?’, the interview guide needed also be able to garner information that permitted the making of a clear distinction between goals expressed by participants that are consistent with Bildung and goals that are consistent with the manifestation of economic goals. McGilchrist’s divided brain hypothesis allows one to make such a distinction based on asking participants about their beliefs regarding the value they want education to have for their pupils. Such a question invites participants to think about their pupil’s education from a perspective of teacher’s own motives for learning in the world. The interview guide used in the study is presented in Appendix 1.

4.4. Procedure

Chemistry teachers were interviewed individually in rooms suitable for the purpose at their respective schools. At the start of each of the two parts of the interview chemistry teachers were read a brief passage whose purpose was to ‘set the stage’ for the proceeding interview questions, that is, prompt participant’s thinking with regard to the themes ‘The teacher’s vision for their teaching’ and ‘The didactic choices teachers make in their teaching’. In the event of chemistry teachers not understanding the interview questions as read by the interviewer, teachers were given the opportunity to read the questions themselves first before answering. Unscripted and spontaneous follow-up questions were used in addition to the scripted questions in the service of garnering rich narratives relevant to the research questions. Interviews lasted between 44 and 58 minutes. All interviews were recorded as digital audio files and transcribed verbatim.

4.5. Analysis

The starting point for the choice of analysis approach is that an analysis of the interview texts must be able to provide cogent evidence in relation to the research question. Significantly, neither Bildung nor ‘content consistent with the manifestation of the economic goals of education’ are operationalised constructs. Indeed, they are such broad and dynamic terms that they defy simple definition. In order that the ‘interpretative security’ of any analysis may be maximised therefore, more than a single theoretical perspective should be employed when searching for content consistent with the core constructs of the study (Kvale & Briankman, 2009).
4.5.1. Concretising teacher’s visions for their teaching as discrete vision statements

An interpretive approach was used to concretise teacher’s visions for their teaching as discrete vision statements. So that statements were concretised as faithfully as possible, the following process was applied: (i) interview transcripts (in Swedish) were read through several times, (ii) for each teacher, vision statements were written in English (iii) vision statements were rigorously compared to original transcript texts in order to discern discrepancies, (iv) vision statements were re-written until a point was reached in which all sense of discrepancy in meaning was completely absent.

4.5.2. Summarising of teacher’s narratives concerning the didactic choices they make in order to realise their visions for their teaching

A discourse analysis approach was used in order to summarise teacher’s narratives concerning the didactic choices they make in order to realise their visions for their teaching. A similar level of rigour to that used when concretising teacher’s visions for their teaching was applied so that all sense of discrepancy in meaning between the summaries of teacher’s narratives and the content of the original interview transcripts was completely absent.

4.5.3. Identification of content consistent with the core themes of the study

Both vision statements concretising teacher’s visions for their teaching as well as summaries of teacher’s narratives concerning the didactic choices they make in order to realise their visions for their teaching were analysed in order to identify content that was ‘in some capacity’ consistent with the core themes of the study, that is, the economic goals of education and Bildung. The different theoretical perspectives used in the analysis are presented in Table 3.

4.5.4. Evaluation of the incidence of and relationship between the core themes of the study for the three interviews

Following the identification of content consistent with the core themes of the study, an evaluation of the vision statements concretising teacher’s visions for their teaching was made in terms of the occurrence of and relationship between the study’s two core themes.
An equivalent evaluation was similarly performed with regard to the summarised narratives concerning the didactic choices teachers make in order to realise their visions for their teaching. In this case however the evaluation was solely concerned with the relationship between the study’s two core themes.

4.5.5. The identification of specific text excerpts in the original interview transcripts illustrating the relationship between the core themes of the study

In order to complement the evaluation of the vision statements as well as the summarised narratives concerning teacher’s work to realise their visions for their teaching, text excerpts in the original interview transcripts illustrating the specific relationship between Bildung and the economic goals of education for each of the teacher were identified.

4.5.6. The identification of common themes amongst the three interviews

The process of transcribing, reading and analysing each of the three interview transcripts permitted the identifying of a number of common themes amongst the three interviews. After first identifying each theme, each of the three interviews were carefully re-read in

| a. | One or more of the dimensions Lindskog found to be consistent with a contemporary understanding of bildning |
| b. | Bohlin’s understanding of Bildung |
| c. | Dewey’s understanding of ‘growth’ |
| d. | Klafki’s understanding of Bildung |
| e. | Klafki’s approach to didactic analysis |
| f. | Sjöström’s three level model for chemistry teaching that embodies a ‘human element’ |
| g. | McGilchrist’s right-hemisphere primacy |
| h. | McGilchrist’s left-hemisphere primacy |
| i. | Content directly conflicting with the ideas underlying Bildung |
| j. | Content directly conflicting with Klafki’s approach to Didactics analysis |
| k. | An economically-driven view of education |

Note 1 A letter has been assigned to each of the perspectives used in the analysis.
order to identify evidence that permitted a clear contrasting of the three interviews with regard to each of the themes.

4.6. Ethical considerations

In Sweden Vetenskapsrådet have created ‘requirements’ in relation to social science research being carried out in order to protect the integrity of research participants (1990). Accordingly, four requirements have been developed in order to serve the interests of private individuals in contexts in which social science research needs their participation so that socially important questions may be explored and answered. The four requirements have been followed in this study. All participants received written information regarding the study’s area of interest prior to their participation (Informationskravet). Participants were further informed who this author was, and that the study was connected to a thesis work in teaching at Malmö University. All participants were informed verbally that their participation was voluntary and all gave consent to participating, either verbally or in writing (Samtyckeskravet). Further all were told both in writing and verbally how much time the interview would take. During the interviews participants were also asked if they were happy to continue with the interview and given the opportunity to stop if they so wished. Both during and following the interviews no materials were recorded or produced by the author that contained information pertaining to the identities of the participants (Konfidentialitetskravet). The participant’s identities are known only to the author, and information pertaining to them has only been used for the purpose of this study (Nyttjandekravet). Nonetheless, despite following the four requirements, it is important to discuss one aspect of the ‘information requirement’ (Informationskravet) that was not followed in its entirety: Participants were not given information pertaining to this study’s specific research question. The reasons underlying this decision have already been discussed.

According to The science council’s text Forskningsetiska principer inom humanistisk-samhällsvetenskaplig forskning (Principles of research ethics within humanistic-social scientific research) such an undertaking can arise in social science research. Significantly, following the conclusion of each interview, participants were asked what they thought of the interview experience. When answering this question two participants inquired about the specific research question. These participants were told what the research question was.
5. Results

5.1. The three interviews

The evaluations of the analysis of each of the three interview texts are presented in turn. The analyses themselves are presented in Appendix 2. The evaluations of the analysis of teacher’s vision statements concretising their visions for their teaching are presented in terms of the occurrence of and relationship between the study’s two core themes. Evaluations are presented both in terms of what teachers want their pupils to learn and the value they want the knowledge pupils learn to have for their pupils in their lives. In cases where a specific relationship between the economic goals of education and Bildung is revealed, relevant text excerpts from the original interview transcripts are presented. The evaluations of the analysis of the summaries of teacher’s narratives concerning the didactic choices they make to realise their vision for their teaching in terms of their consistency with the core themes of the study are presented for each interview subsequent to the presentation of results concerning teacher's visions for their teaching. Again, results are presented both in terms of what teachers want their pupils to learn and the value they want the knowledge pupils learn to have for their pupils in their lives. Where a specific relationship between the economic goals of education and Bildung is revealed, relevant text excerpts from the original interview transcripts are presented.

5.1.1. Teacher 1: Vision for their teaching

The vision of Teacher 1 regarding what they want their pupils to learn is characterised by the capacities related to Bildung being predominantly developed in the interests of serving the learner’s mastery needs, that is, the mastery of future study and work. In addition, they are also linked with the service of the state’s economic interests.

Teacher 1: “… eftersom jag jobbar huvudsakligen på ett högskoleförberedande program, … de ska utveckla en självständighet, en förmåga att själva lära sig framöver, …”

Teacher 1: “… ett kritiskt förhållningssätt att reflektera över kunskap … Jag tänker mig eftersom det är ett studieförberedande program så handlar det om fortsatta studier. Det handlar om yrken då man behöver ha det här kritiska förhållningssättet, problemlösningsförmågan. Så
det handlar liksom inte om att trava fakta de ska bära mig sig utan en förmåga att hantera kunskap”

One element of the vision of Teacher 1 that does not conform to this pattern is a vision of the pupil educated in chemistry as responsibly participating in society as a collective project.

The vision of Teacher 1 regarding the value they want the knowledge pupils learn to have for the pupils is primarily concerned with the pupil, through having scientific knowledge, having greater power to master their personal situation, even though Teacher 1, when describing their general vision, makes a distinction between education as seen in an economic paradigm and a perspective of individual emancipation.

5.1.2. Teacher 1: The didactic choices they makes in order to realise their vision for their teaching

Although the vision of Teacher 1 contains elements of Bildung, Teacher 1 describes marginalising such elements. This is expressed in two ways. Firstly through Teacher 1 describing their teaching as being primarily focused on the teaching of elementary knowledge/core content.

Teacher 1: “… då lägger man mycket energi på att jobba med de här mest grundläggande färdigheterna, och det är klart, när man kanske inte alltid de här mer utvecklande målen som ligger lite längre fram så att säga.”

Secondly, through Teacher 1 describing learning approaches that promote Bildung, e.g. open questions that link chemistry to questions concerning products/substances in pupil’s every days lives, as being primarily utilised to promote pupils’ learning of elementary knowledge/core content.

Teacher 1: “så där kan man bruka använda det som ett exempel när man introducera det området … Så att, man, ja, kopplar det till deras, eller ja, till någonting som känns lite mer

8 This conclusion is questionable however since Teacher 1 later relates back to their vision for their teaching and speaks in terms of using knowledge in order to relate to one’s surrounding world, rather than gain power through comprehending it. The vision of Teacher 1 regarding the personal value knowledge has for the pupil may be therefore more Bildung-centered than what can be inferred from the initial description by Teacher 1 of their vision for their teaching.
Significantly, a primary reason Teacher 1 prioritises the teaching of elementary knowledge/core content over ‘more developmental’ goals is economic goals as manifested within the Swedish school education system.

Teacher 1: “… alltså kunskapen mäts och följs up och kontrolleras väldigt hårt, så att, det är det ett väldigt fokus mot att nå så goda betyg som möjligt. Och jag tror att det kanske hämmar en … man vågar inte ta ut svängarna, därför att då hinner jag kanske inte med det momentet, och jag vet att det kommer oftast när det nationella kursprovet, … vi har ett betygsystem också som drar ett skärpt gräns mellan godkänt och icke godkänt … där mycket fokus blir på att se till att alla kommer över den här gränsen, så mycket energi läggs på det. Och tror jag att man kan tappa bort någonting ibland …”

However, an additional reason why Teacher 1 prioritises the teaching of elementary knowledge/core content over ‘more developmental’ goals is that Teacher 1 believes that the teaching of such knowledge/content is necessary if pupils are to be able to work towards the ‘more developmental’ goals. Significantly, Teacher 1 also seems to suggest that pupil’s knowledge in elementary chemistry needs to be developed first if pupils are to work meaningfully with relating chemistry to relevant social issues.

Teacher 1: “…där tanker jag att, jag inbillar mig att man behöver vissa grundläggande kunskaper för att kunna jobba med problemlösning och allt [hör inte] som är utvecklande…”

5.1.3. Teacher 2: Vision for their teaching

The vision for Teacher 2 regarding what they want their pupils to learn contains elements consistent with Bildung as well as elements consistent with both McGilchrist’s left-hemisphere primacy and education as seen in an economic paradigm. In addition there are elements in the vision of Teacher 2 that are in conflict with ideas underlying Bildung.
Regarding the value Teacher 2 wants the knowledge pupils learn to have for the pupils, the vision of Teacher 2 contains elements consistent with both McGilchrist’s left-hemisphere primacy and education as seen in an economic paradigm. There are also elements that are in conflict with ideas underlying Bildung. There are no elements in this part of the interview with Teacher 2 consistent with Bildung.

5.1.4. Teacher 2: The didactic choices they make in order to realise their vision for their teaching

Although the vision of Teacher 2 contains elements consistent with Bildung, Teacher 2 describes marginalising such elements. With regard to the development of pupil’s reflective capacity this is expressed through Teacher 2 viewing the need to cover the course syllabus as limiting the time they have available and through Teacher 2 viewing pupils as increasingly lacking the patience and motivation for learning.

Teacher 2: “… varje lektion måste man börja med någonting nytt. De hinner liksom inte precisa det vad vi gått igenom.”

With regard to linking chemistry to pupil’s everyday lives this is expressed through Teacher 2 asserting that they only have time for doing ‘small things’, and through expressing that despite having the goal to do so they have not developed that side of their teaching.

Teacher 2: “jag har inte tid för att göra stora utvikningar men ibland kan man ta lite såna små saker bara så att de kommer ihåg.”

Regarding the first expressed cause in each of these two examples it is economic goals as manifested within the Swedish school education system that underlie the reasons Teacher 2 gives for having insufficient time for developing capabilities related to Bildung.

Teacher 2: “Man kan säga så att tiden, man har inte oändlig med undervisningstid, och vi har ju vissa mål, visst innehål som eleverna ska kunna så faktum är att det är lite svårt att avvika från det. Det är lite under stress faktiskt att man ska hinna med det och det och det. Så att om jag skulle göra som jag ville skulle jag har mer tid så att man kunde jobba liksom, göra mer.”
5.1.7. Teacher 3: Vision for their teaching

The vision for Teacher 3 regarding what they want their pupils to learn is characterised by the capacities related to Bildung being primarily developed in the interests of serving pupil’s mastery needs. In addition, the development of the Bildung-related capacity of having greater control over one’s learning is linked with the service of the state’s economic interests.

Teacher 3: “… jag vill att eleverna ska ta kontroll över sitt eget lärande, … det är något som oavsett vad de väljer att göra senare i livet så är detta förmåga något som kommer att hjälpa dem senare i framtida studier eller om de väljer att jobba i nån, ja, ut i arbetslivet ett tag. Det är ju ändå en, högskola, alltså, en vidareutbildning alltså, det är framförallt det vi förbereder dem för, universitet och högskola. Så det är ju framförallt det som jag tänker på.”

Regarding the value Teacher 3 wants the knowledge pupils learn to have for the pupils, each vision statement by Teacher 3 is consistent with Bildung. It is worth noting that waking ‘an intrinsic curiosity and desire for learning’, according to the analysis, stands out as the vision statement by Teacher 3 that is most consistent with Bildung.

5.1.8. Teacher 3: The didactic choices they make in order to realise their vision for their teaching

Regarding the elements of the vision of Teacher 3 that are consistent with Bildung, Teacher 3 describes realising these elements. This is expressed in two ways. Firstly, through Teacher 3 describing a core aspect of how they work as developing in pupils capabilities that are not bound to a particular subject of instruction. Secondly, through Teacher 3 providing a rich description of how they work to promote these elements. However, although Teacher 3 describes realising these elements, Teacher 3 also describes the marginalising of pupil’s development of an intrinsic desire and interest for learning. This is expressed through Teacher 3 describing a number of factors that make developing an intrinsic curiosity and desire for learning challenging.

Teacher 3: “man har ju ett visst innehåll, ett innehåll man ska gå igenom. Man vill ju också ge eleverna en möjlighet att, att, man vill vara tydlig med att konkretisera ett betygskriterier. Man vill vara tydlig med att också tala om för eleverna vad de behöver göra för att uppnå nästa steg. Och det är klart att det tar ju bort lite av det lustfyllda lärandet om man har, dels är det
väldigt studiemotiverade elever, som lätt får det här tunnelseendet, att det bara handlar om betyg. Då blir det väl lätt att fokus blir bara där. Detta är ingenting jag behöver för att detta är ingenting som är viktigt utifrån det centrala. Vad behöver jag liksom minimum för att kunna uppnå ett visst betyg, det är lite den. De blir väldigt strategiska”.

5.2. Contrasting the three interviews

5.2.1. Common Bildung-related capacities amongst teachers

Table 4 summarises the different Bildung-related capacities described by teachers in their visions of their teaching. Indicated for each capacity are the teachers who have described that capacity in their teaching vision. Interestingly, there is significant commonality amongst teachers regarding the Bildung-related capacities they describe.

Table 4. The different Bildung-related capacities described by teachers in their visions of their teaching.

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ability to independently manage/have greater autonomy over/successfully take responsibility for one’s learning</td>
<td>Teacher 1, 2 and 3</td>
</tr>
<tr>
<td>Knowledge one owns as part of oneself, based in an intrinsic curiosity and desire for learning and that allows one to have greater autonomy in one’s daily life</td>
<td>Teacher 1 and 3</td>
</tr>
<tr>
<td>A critical posture concerning the truth content of information</td>
<td>Teacher 1 and 3</td>
</tr>
<tr>
<td>A reflective distance regarding how knowledge is created within the natural sciences and how scientific knowledge evolves</td>
<td>Teacher 3</td>
</tr>
<tr>
<td>A reflective distance towards knowledge one has learned, an ability to make appropriate use of it/independently analyse</td>
<td>Teacher 1 and 2</td>
</tr>
<tr>
<td>The ability to responsibly participate in society as a collective project, where one important goal of this project is the promotion of sustainability</td>
<td>Teacher 1</td>
</tr>
</tbody>
</table>

Of the six capacities described in total, four are shared by at least two teachers in their vision for their teaching. Indeed, one capacity, the ability to have autonomy over one’s own learning, is shared by all three teachers in their teaching visions. Only two of the six Bildung-related capacities reported by the three teachers arise in the teaching visions of one teacher alone.

5.2.2. Teacher’s experienced autonomy

Differences in experienced autonomy in their teaching for the three teachers are revealed when contrasting the interview transcripts. Whereas Teacher 1 and Teacher 2 describe
several external controlling factors as restricting them in their freedom to realise their vision for their teaching, Teacher 3, whilst conceding the existence of constraining factors, illustrates through the choices they make an experience of freedom in their work to realise their visions for their teaching.

5.2.3. Teacher’s didactic work

Differences regarding the experienced degree of intentionality in teacher’s didactic work manifest when comparing and contrasting the interview transcripts. Thus, Teacher 3 discusses their teaching activities at length during the first part of the interview, even though there were no questions in this part of the interview asking chemistry teachers about their specific teaching work. Teacher 1 and Teacher 2 on the other hand did not do this. Further, the descriptions by chemistry teachers of their chemistry teaching were significantly more concrete and vivid for Teacher 3 than for Teacher 1 and Teacher 2. Indeed, the examples given by Teacher 1 and Teacher 2 seemed at times randomly selected or vague.

5.2.4. Teacher’s ability to account for and recall their vision for their teaching

Differences related to the degree to which teachers were able to coherently account for and later easily recall their vision for their teaching are revealed when comparing and contrasting the three interview transcripts. Thus, Teacher 1 and Teacher 3 gave immediate, concise and coherent accounts of their vision for their teaching in the first part of the interview. In contrast, the vision for their teaching described by Teacher 2 was noticeably fragmented when compared to the visions described by the other teachers. With regard to being able to coherently recollect/re-account for their vision for their teaching later in the interview, Teacher 1 and Teacher 3 were able to do this with ease. In comparison, Teacher 2 needed prompting by the interviewer during the second part of the interview in order to recall the details of their vision for their teaching.
6. Discussion

The results of this study reveal a complex picture regarding the marginalisation of Bildung. In order that this picture can be more readily organised we begin this discussion by first summarising the study’s findings in terms of the different ways in which Bildung is marginalised.

6.1. The marginalisation of Bildung at the level of teacher’s vision for their teaching

The original purpose of the first part of the interview used in this study was to illicit from teachers, within the context of their visions for their teaching, content that was related to Bildung. Importantly, the analysis showed the visions for their teaching of all three teachers to contain Bildung-related content. Unexpectedly however, the analysis also revealed that a marginalisation of Bildung could be discerned at the level of teacher’s visions for their teaching for all three teachers as well. Table 5 summarises the different ways in which Bildung is marginalised at the level of teacher’s visions for their teaching and for which teachers these different forms of marginalisation occur.

Table 5. Summary of the marginalisation of Bildung at the level of teacher’s vision for their teaching

<table>
<thead>
<tr>
<th>Marginalisation</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers visions for their teaching (in relation to what value they want the knowledge their pupils learn to have for them in their lives) contain no elements related to Bildung</td>
<td>Teacher 2</td>
</tr>
<tr>
<td>Ideas about education inconsistent with Bildung ideals dominate the teacher’s vision for their teaching</td>
<td>Teacher 2</td>
</tr>
<tr>
<td>To differing degrees, capacities related to Bildung are viewed as being developed in the interest of serving individual and societal mastery needs</td>
<td>Teacher 1 and 3</td>
</tr>
</tbody>
</table>

6.2. The marginalisation of Bildung at the level of teacher’s (reports of their) chemistry teaching

From the outset, this study’s purpose was to garner qualitative evidence describing in what aspect, if any, economic goals, as manifested within the Swedish school education system, marginalise the curriculum’s humanistic or Bildung goals in chemistry teacher’s (reports of
their) chemistry teaching. Importantly, the results of the analysis show that all three teachers report the marginalisation of Bildung resulting from factors that can be directly linked to economic goals as manifested within the Swedish school education system. Significantly however, the analysis also reveals additional pathways through which Bildung is marginalised at this level. Table 6 summarises the different pathways through which Bildung is marginalised at the level of teacher’s teacher’s (reports of their) chemistry teaching and for which teachers these different forms of marginalisation occur.

Table 6. Summary of the marginalisation of Bildung at the level of teacher’s (reports of their) teaching

- Economic goals, as manifested within the Swedish school education system, cause a marginalisation of BildungTeacher 1, 2 and 3
- Approaches that can promote Bildung are utilised in the service of promoting pupil’s learning of chemistry contentTeacher 1
- Factors related to pupils own attitudes towards learning and education marginalise BildungTeacher 1 and 3
- A belief that elementary knowledge must first be learned before goals valuable to Bildung can be pursued marginalises BildungTeacher 1
- A low expressed degree of intentionality in teachers Bildung-related Didactics marginalises BildungTeacher 2

6.3. The marginalisation of Bildung at the level of the construct validity of teacher’s Bildung-consistent content

In order that the analysis of interview transcripts could reveal as much Bildung-related content as possible, the analysis focussed on discerning content that was ‘in some way’ consistent with Bildung. A consequence of this approach however is that content identified as being Bildung-related may in important ways insufficiently represent the Bildung construct. In light of this, it is valuable to this discussion that aspects in which Bildung is marginalised at the level of the construct validity of teacher’s Bildung-consistent content are considered.
6.3.1. *Bildung*-related content in teacher’s visions for their teaching is (with a single exception) concerned exclusively with ‘cognitive Bildung’.

The different theories of Bildung and growth presented in section 3.1 of this work reveal a consistency amongst scholars regarding a view of Bildung as a broad construct encompassing moral/ethical dimensions, not only cognitive. The different Bildung-related capacities described by teachers in their visions of their teaching and presented in Table 10 are (with a single exception) exclusively representative however of ‘cognitive Bildung’, that is, the development of reflective and critical thinking capacities, as well as new knowledge structures that ultimately provide the individual with greater degrees of self-determination. Only a single aspect of the vision of Teacher 1, that of developing in pupils the ability to responsibly participate in society as a collective project, where one important goal of this project is the promotion of sustainability, is consistent with Bildung as a construct including moral/ethical dimensions.

6.3.2. Approaches chemistry teachers report using to make chemistry relevant to pupils are likely insufficient to promote Bildung.

Within a Bildung paradigm learning is meaningful to the learner and intrinsically-driven so that content learned connects in an immediate way to his or her contextual reality giving learning immediate relevance and value. In this view, the linking of subject content to pupil’s everyday realities is of absolute necessity if teaching is, as Dewey describes, to promote pupil’s ‘growth’ (Cited in Stuckey et al., 2013). With regard to the present study, all three teachers describe linking chemistry content to pupils every day lives. Crucially, if one uses Sjöström’s three-level model describing different approaches to chemistry teaching that embody a ‘human element’ as a lens to interpret teacher’s reported efforts to make chemistry more relevant to pupils, none of the examples provided by the three teachers are consistent with a Bildung-oriented chemistry teaching, termed ‘critical-philosophical approach’, and corresponding with the highest level of the Sjöström’s model (2013). Indeed, with the exception of Teacher 1, who provides a single example consistent with Sjöström’s level 2, ‘socio-cultural context’, all of the examples provided by the three teachers are consistent with ’applied chemistry’, corresponding with level 1 of Sjöström’s model.
6.4. Conceptualising teacher’s ‘Bildung-orientation’ in relation to their chemistry teaching

The initial discussion of the results of this study shows that although Bildung-related content can be found in the teaching visions of all three teachers, Bildung is marginalised at the level of their visions for their teaching, at the level of teacher’s reports of their chemistry teaching, and at the level of the construct validity of teacher’s Bildung-consistent content. Significantly, and of importance to the research question, the results of this study shows that economic goals, as manifested within the Swedish school education system, marginalise Bildung. This is reflected in the accounts of Teacher 1 and Teacher 2 in which both teachers describe multiple contextual factors that inhibit them in their ability to realise their respective visions for their teaching. For Teacher 1 these factors are large class sizes, a limited number of available lessons, the course syllabus, national exams, pressure to make sure every pupil passes the course, and a greater measurement and control of pupil’s knowledge in today’s educational system. For Teacher 2 these factors are limited teaching time, syllabus goals, ‘central content’, the need to go through something new in every lesson, pupils’ and parents’ grade fixation, the demand placed upon them from multiple parties that every pupil should pass the subject, and a growing discourse in which teacher’s salaries are connected to the results pupils achieve. Significantly, a marginalisation of Bildung as related to economic goals is also found in the account of Teacher 3. When explaining why the promotion of an intrinsic curiosity and desire for learning in pupils is so challenging, this teacher describes the course’s ‘central content’, the work of Teacher 3 to concretise for the pupils what it is they need to do in order to reach higher criteria for the course (i.e. this teacher’s use of assessment for learning9), and pupil’s strategic thinking regarding their achieving of a certain grade as underlying this difficulty.

When the results of this study are viewed in the context of the research question alone however, the broader and more nuanced picture that this study provides regarding how

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9 Seemingly by defining for pupils what it is they need to do in order to reach higher criteria for a course, one potentially undermines opportunities that might exist within the pupil for pursuing their own innate learning journey by deliberately shifting their attention to the pathway they must take in order to reach a set of predefined goals. Considering that assessment for learning is a mandatory element of current Swedish teacher education programmes (See for example teaching programmes at Malmö University) this result highlights the power of economic forces to marginalise Bildung within Swedish education.
Bildung is marginalised in the three teacher’s vision for their teaching and reports of their teaching is not possible to view. A fruitful way of proceeding with this discussion therefore is to discuss the results in terms of each teacher’s unique orientation towards promoting Bildung in their chemistry teaching.

6.4.1. Teacher 1 - Orientation to promoting Bildung in their chemistry teaching

At the level of the teacher’s vision for their teaching - Of the three teachers only Teacher 1 encompassed the full breadth of the Bildung construct in their vision for their teaching. Of importance here is that this teacher also was able to concisely and coherently account for their vision for their teaching in the first part of the interview and later coherently re-account for it when discussing the choices they made to realise their teaching vision. That Teacher 1 was able to do this suggests that they had a clear understanding and ownership of their vision for their teaching prior to the interview. There is a clear basis therefore to believe that the orientation towards Bildung of Teacher 1 at the level of their vision for their teaching is to promote Bildung in their chemistry teaching. However, although Teacher 1 appears to be oriented towards promoting Bildung at the level of their vision for their teaching, the utility that Teacher 1 sees Bildung-related capabilities conferring is largely focussed on their usefulness in serving both pupil’s and the state’s mastery interests. Importantly, such a view does not reflect an approach to learning consistent with Bildung, but rather, an approach to learning aligned with an economic view of education.

At the level of the choices teachers report making to realise their vision for their teaching - Although the vision of Teacher 1 for their teaching is oriented towards promoting Bildung, this orientation is unrealised at the level of the choices Teacher 1 makes to realise their vision for their teaching. As has already been discussed, economic goals as manifested within the Swedish school education system are an important contextual factor underlying why they find it challenging to realise their vision for their teaching. There are however additional factors that are crucial to understanding why this teacher’s Bildung-orientation is unrealised at this level. Significantly, whilst economic goals may be viewed as contextual factors, each of these additional factors are related to the approach Teacher 1 reports as using in their chemistry teaching, and may, as a consequence, be described as being particular to the teacher themselves. For example, Teacher 1 reports having the belief that one must teach elementary knowledge first before one can connect the subject to relevant societal issues and
work with ‘more developmental’ goals. According to Eilks et al. (2013) such an approach can be described as a structure of the discipline (SOD) or fundamental chemistry (FC) approach. Significantly, such an approach to teaching chemistry is seen as prioritising the learning of concepts over the pupil’s psychological or motivational development as well as being antithetical to a context-based approach to teaching chemistry (ibid). This is a crucial point since context-based approaches to chemistry teaching, in which chemistry teaching is built around chemistry issues that affect pupils in their lived lives, are consistent with chemistry teaching that contains a human element (Sjöström & Talanquer, 2014). Thus the belief of Teacher 1, that one must teach elementary knowledge first, marginalises this teacher’s desire to promote Bildung through their chemistry teaching. Importantly however, Teacher 1 does not report an exclusive SOD or FC approach to their chemistry teaching. Whilst discussing the value they want knowledge in chemistry to have for their pupils, Teacher 1 gives an example of how one can create a reflective discussion around the development and use of modern batteries when teaching electrochemistry. Crucially however, such an example is consistent only with level 2, that of ‘socio-cultural context’, of Sjöström’s three-level model describing approaches to chemistry teaching that embody a ‘human element’. The specific example Teacher 1 provides therefore, although identified as Bildung-related in the analysis, represents a marginalisation of the term at the level of its construct validity. Of greater significance however is the fact that Teacher 1 uses this example as an example of how they utilise themes that are of relevance to pupils as a means to ‘opening pupils up’ and making them more receptive to learning elementary knowledge/core content. A crucial value to Teacher 1 of linking chemistry to pupils everyday lives therefore is to support this teacher’s SOD or FC teaching approach.

6.4.2. Teacher 2 - Orientation to promoting Bildung in their chemistry teaching

At the level of the teacher’s vision for their teaching - Although the analysis shows the presence of Bildung-related content in this teacher’s vision for their teaching, content that is either in conflict with Bildung or consistent with ideas of mastery and economic growth dominates this teacher’s teaching vision. Significantly, the Bildung-related content revealed by the analysis was fragmentary in nature and only weakly associated with Bildung. In addition it was found only in relation to the question ‘What do you want your pupils to learn through their schooling?’. An additional result which is valuable in helping us understand this teacher’s Bildung-orientation is the fact that Teacher 2 needed prompting by the
interviewer during the second part of the interview in order to recall the details of their vision for their teaching that were connected to Bildung. Taken together, these results suggest a significant domination of themes inconsistent with Bildung for Teacher 2 and only a fragmentary and weak association with Bildung. At the level of this teacher’s vision for their teaching therefore the Bildung-orientation of Teacher 2 is ‘considerably marginalised’, being possibly even ‘non-significant’.

At the level of the choices teachers report making to realise their vision for their teaching - Just as for Teacher 1, economic goals as manifested within the Swedish school education system are an important contextual factor underlying why Teacher 2 finds it challenging to realise their vision for their teaching. It is not only economic goals, as a contextual influencing factor, that marginalise Bildung ‘as a developmental possibility’ for Teacher 2 however. Again, as in the case of Teacher 1, a number of additional factors that are particular to Teacher 2 themselves impact the ability of this teacher to realise goals related to Bildung in their teaching. Prime amongst these is the low degree of intentionality expressed by Teacher 2 with regard to realising the goal of linking chemistry to pupil’s everyday lives. Here Teacher 2 precludes Bildung as a developmental possibility by expressing low intentionality with regard to making the kind of improvements in their teaching that would allow Teacher 2 to better connect chemistry to pupil’s lived realities. A second internal factor that marginalises Bildung in this teacher’s teaching is related to the quality of the examples they give in relation to their existing efforts to link chemistry to pupils everyday lives. Here examples are consistent only with level 1 of Sjöström’s three-level model describing different approaches to chemistry teaching that embody a ‘human element’.

6.4.3. Teacher 3 - Orientation to promoting Bildung in their chemistry teaching

At the level of the teacher’s vision for their teaching - Although there is no evidence in the vision of Teacher 3 for a marginalisation of Bildung similar to that found for Teacher 2, the Bildung-orientation of Teacher 3 at the level of the teacher’s vision is less clear cut than that of Teacher 1. Significantly, there is no content in the vision of Teacher 3 that encompasses the moral/ethical dimensions of the Bildung construct. Rather, Bildung-related content is concerned exclusively with the cognitive dimensions of Bildung. This is a crucial finding since a Bildung which is solely cognitive should be viewed as a process of self-determination development without there necessarily being recourse to ‘human sense’ or
responsibility (Klafki, 2000b). In view of this one can quite justifiably question whether cognitive Bildung is Bildung at all. Indeed, in the absence of a moral/ethical compass, the capacity for greater self-determination might lead not towards humanistic ends, but rather, towards the accrual of greater power and mastery whilst ignoring the ‘human cost’. Such activity would quite rightly be viewed as being consistent with an economic perspective and thus in conflict with Bildung. Clearly, cognitive Bildung does not determine unethical or irresponsible action, but at the same time it does not guarantee that one steps away from it. Cognitive Bildung must therefore be seen as a marginalised form of Bildung that can in some circumstances wholly preclude to Bildung. Crucially, when discussing what they believed pupils should learn through schooling, Teacher 3 saw the principle utility of the Bildung-related capabilities that they described as being the service of pupil’s mastery interests. Further, Teacher 3 also linked the Bildung-related capacity of developing in pupils greater control over their learning with servicing the state’s economic interests. Thus, when discussing what they believed pupils should learn through schooling, Teacher 3 in all instances saw the development of capabilities consistent with a ‘cognitive Bildung’ as having their primary value in serving pupil’s (and in once instance the state’s) mastery needs. Hence, this teacher’s cognitive Bildung orientation, at the level of their vision for their teaching (and with regard of what they believed pupils should learn through schooling) is ‘greatly’ aligned with an economic view of education and therefore may ‘to a great extent’ not be oriented to promoting Bildung at all.

At the level of the choices teachers report making to realise their vision for their teaching - Unlike Teacher 1 and Teacher 2, Teacher 3 does not express being significantly hindered in their work to realise their vision for their teaching. However, this teacher does express there existing contextual factors in their work to realise one of their visions for their teaching, that of promoting in pupils an intrinsic curiosity and desire for learning. As has already been described in the introduction of this section, all three factors can be related to economic goals as manifested within the Swedish school education system. Significantly however, there appears to be evidence supporting the idea that factors personal to Teacher 3 themselves also marginalise the promotion in pupils of an intrinsic curiosity and desire for learning. Firstly, Teacher 3 asserts that their overriding vision for their teaching is the development in pupils of their taking control over their own learning. Secondly, assessment for learning is the primary tool used by Teacher 3 to assess the development of this capacity,
even though Teacher 3 describes assessment for learning as compromising their work to develop in pupils an intrinsic curiosity and desire for learning. Thus, one can surmise that developing in pupils their taking control over their own learning is of significantly greater importance for their development, in the view of Teacher 3, than is developing in pupils an intrinsic curiosity and desire for learning. This because Teacher 3 is prepared to compromise their work with the latter in order to succeed with the former. One can conclude therefore that this teacher assists in the marginalisation of the development of an intrinsic curiosity and desire for learning in pupils by deprioritising it in their didactic work. Interestingly, the development of an intrinsic curiosity and desire for learning in pupils is shown by the analysis to be the capacity which is most strongly related to Bildung in this teacher’s vision for their teaching. One could argue therefore that despite this capacity being marginalised, it still represents a significant pathway to Bildung in this teacher’s teaching. Significantly, during the interview Teacher 3 asserted that linking chemistry to pupil’s lived lives was crucial to developing an intrinsic curiosity and desire for learning in pupils. The examples Teacher 3 gives in relation to their work to link chemistry to pupil’s daily lives however are consistent only with with ‘applied chemistry’, that is, level 1 of Sjöström’s three-level model describing different approaches to chemistry teaching that embody a ‘human element’.

Despite the existence of both contextual and factors personal to the teacher which marginalise the work of Teacher 3 to develop in pupils an intrinsic curiosity and desire for learning, there is however strong evidence that Teacher 3 succeeds in developing the Bildung-related capacity of ‘taking control over one’s own learning’. For example, Teacher 3 provides a vivid and detailed description of how they work to develop this capacity in their pupils. Also, Teacher 3 expresses a clear conviction that they see evidence of pupils developing this capacity over the duration of a course. Further, Teacher 3 was able to coherently account for and later easily recall their vision for their teaching, suggesting that they had a clear ownership of their vision for their teaching prior to the interview taking place. However, when viewed through a lens of this teacher’s cognitive Bildung orientation there are grounds for questioning the legitimacy of the idea that this teachers promotion of pupil’s taking control over their own learning is in fact an activity related to the promotion of Bildung. Significant in this respect is the result that Teacher 3 views pupil’s development of the capacity to take control over their learning as being primarily of utility to pupils in higher education through giving them greater ability to master learning challenges. Further, this
teacher views the primary responsibility of the gymnasium teacher as being the preparation of pupils for higher education. Thus, the primary utility to pupils of having this capability in this teacher’s vision for their teaching is ‘greatly’ aligned with an economic view of education. There is a strong basis therefore for viewing this teacher’s work to develop this capability in their pupils as being a cognitive Bildung orientation that is ‘to a great extent’ not oriented to promoting Bildung.

‘Bildung-orientation’ profiles for the three participating teachers are presented in summarised form in Appendix 3.

6.5. Impact of ‘implicit’ factors on teacher’s chemistry teaching

The first major outcome of this study is the unique profile for each teacher describing how economic goals in the form of external contextual factors impact their working realities so that Bildung-related dimensions found in their respective visions for their teaching become marginalised. Not initially anticipated however was the unique profile for each teacher describing how ‘implicit’ factors, that is, factors that are particular to the teachers themselves which are outside of their awareness, impact their ability to realise Bildung-related goals in their vision for their teaching. Thus, Teacher 1, despite having a holistic view of Bildung in their vision for their chemistry teaching was unaware that at the same time they marginalised that view through seeing Bildung-related capabilities as ultimately having value through serving pupil’s mastery needs. Teacher 1 was further unaware that their own structure of the discipline (SOD) approach, their utilising of the linking of chemistry to pupil’s lived lives in order to realise their SOD approach, and the examples they used to link chemistry to pupil’s lived lives all marginalised Bildung. It is valuable to reflect at this point upon why, despite describing a holistic view of Bildung at the level of their vision for their chemistry teaching, Teacher 1 marginalised Bildung to such a degree in their (report of their) chemistry teaching. One possible answer lies in the result from the analysis of the interview transcript for Teacher 1 which suggests a low degree of intentionality for this teacher regarding their didactic work. It might be therefore that insufficient conscious engagement in a Bildung-related didactic praxis is an important factor underlying why Bildung is unrealised for this teacher in their (report of their) chemistry teaching. Interestingly a similar result was also found for Teacher 2. However, unlike for Teacher
1, this result is entirely consistent with this teacher seemingly not being open to Bildung as a possibility, but rather, being instead powerfully invested in an economic view of education.

Unlike for Teacher 1 and Teacher 2, the analysis of the interview transcript for Teacher 3 indicated their having a high degree of intentionality in their didactic work with this teacher succeeding in helping pupils develop effective strategies for taking control over their own learning. Importantly, this capability is one of the dimensions Lindskog (2007) found to be consistent with a contemporary understanding of bildning. It is also consistent with Bohlin’s (2014) understanding of Bildung. However, the cognitive Bildung orientation for this teacher at the level of their vision for their teaching (and with regard to developing in pupils effective strategies for taking control over their own learning) reflected an orientation towards Bildung that was ‘greatly’ aligned with an economic view of education and therefore ‘to a great extent’ likely not oriented to promoting Bildung. Further, Teacher 3 was also judged to having assisted in marginalising the development of an intrinsic curiosity and desire for learning by deprioritising it in their didactic work. One can therefore argue that the prioritising by Teacher 3 of pupils taking control over their own learning results in an insufficient engagement in a Bildung-related didactic praxis for this teacher in their chemistry teaching. Thus, a significant conclusion that we can reasonably draw is that factors particular to the teachers themselves that are outside of their awareness ultimately lead these teachers to being inadequately engaged in a Bildung-related didactic work. Table 7 summarises the ‘implicit’ factors that underly teacher’s inadequate engagement in a Bildung-related didactic work.

In light of this conclusion, it seems pertinent to ask the following question: What explanations do we have available to us that can reveal the underlying causes of the ‘implicit’ factors that might limit teachers potential for engagement in a Bildung-related didactic work, and that can ultimately be of value to us in helping teachers become

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10 In asking this question we are opening up to the idea that the results of this study are in some way generalisable. However, even though the external validity of this study is limited, it is not inconceivable that a number of the implicit factors described in Table 7 may be internal factors that influence other chemistry teachers as well.
aware of the factors inhibiting their work to realise Bildung-relevant goals in their chemistry teaching?

Table 7. ‘Implicit’ factors underlying teacher’s inadequate engagement in a Bildung-related didactic praxis

<table>
<thead>
<tr>
<th>Factor</th>
<th>Teacher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being powerfully invested in an economic view of education</td>
<td>Teacher 2</td>
</tr>
<tr>
<td>Seeing the value of the development of capacities and knowledge structures consistent with Bildung as having primary value in serving pupil’s mastery needs</td>
<td>Teacher 1 and 3</td>
</tr>
<tr>
<td>Using pathways that can promote Bildung in the service of the teacher’s mastery needs</td>
<td>Teacher 1</td>
</tr>
<tr>
<td>A cognitive Bildung orientation</td>
<td>Teacher 3</td>
</tr>
<tr>
<td>Insufficient awareness for the breadth and nature of themes needed to promote Bildung through linking chemistry to pupil’s lived lives</td>
<td>Teacher 1, 2 and 3</td>
</tr>
<tr>
<td>The teacher prioritising goals likely not oriented towards promoting Bildung over their Bildung-related goals</td>
<td>Teacher 3</td>
</tr>
</tbody>
</table>

Significantly, the first four factors described in Table 7. can all be related to McGilchrist’s divided brain hypothesis, and more specifically to his description of the mastery focussed left hemisphere which, having taken for itself the role of primacy utilises the right brain’s ‘openness to that which is not itself’ solely to gain the knowledge it needs to allow it to pursue its mastery and power goals (2009). Crucially, in such a ‘left-brain primacy’ mindset, which McGilchrist claims to be the predominant mindset of the contemporary Western world, the value of knowledge as well as the skills that knowledge generates is its utility in furthering our mastery and power strivings. Significantly, it is worth pointing out that McGilchrist doesn’t view such a mindset as necessarily harmful. Our ability to understand our environment and master it through our tool building is after all crucial to our survival and prosperity. What is problematic according to McGilchrist is when such a mindset comes to dominate how we live our lives. In such circumstances a ‘right-brain primacy’ mindset, a mindset in which knowledge has value in the context of our relationship to different aspects of the living world, and which is also highly consistent with ideas related to the process of Bildung, becomes chronically marginalised. Significantly for this study, it is such a situation that can explain the first four factors described in Table 7. A crucial course of action therefore in helping teachers become aware of the factors inhibiting their work to realise Bildung-related goals in their teaching is to work to facilitate in them, during for example their teacher training, a reflective awareness for their own personal beliefs.
about the value of studying and learning and how their beliefs are related to ideas of an economic view of education (‘left-brain primacy’) and Bildung (‘right-brain primacy’). Further, teachers need to be given an opportunity to become reflectively aware of how they marginalise a Bildung-related didactic praxis as a result of their personal beliefs about the value of studying and learning and how they might address such a marginalisation. Finally, teachers also need to be given the opportunity to become reflectively aware of what may be a learned tendency in our contemporary society to utilise people’s potentials and capacities solely for mastery gain, to its connection with ‘left-brain primacy’, and how Bildung as a possibility in pupil’s learning can be extinguished through it.

Of the remaining factors in Table 7, the fifth can be related to the degree to which chemistry teachers are engaged in contemporary didactic research in chemistry and science; specifically, context-based as well as critical approaches to science and chemistry teaching e.g. Sjöström’s ‘critical-philosophical approach’. Significantly, teacher’s own teacher identities can be a factor in determining to what extent they are prepared to invest time and effort in integrating context-based and critical approaches into their own chemistry teaching. According to Roberts (2011), science teachers own science education as well as past teaching experience will have a significant impact on what they view as being an appropriate science education. Thus, chemistry teachers who for example have more traditional structure of the discipline (SOD) backgrounds regarding their own chemistry education, and who use a SOD approach in their current chemistry teaching, might feel reluctant to engage themselves in context-based or critical approaches to chemistry teaching. Indeed, there may also be epistemological barriers preventing science teachers from engaging themselves in more contemporary approaches to science education (ibid). Thus, it is crucial that teaching programmes offer trainee chemistry teachers pathways through which they are able to work meaningfully with didactic research in chemistry and science and integrate it into their chemistry teaching.

Regarding the final factor in Table 7, one plausible explanation for Teacher 3 prioritising the development of pupil’s taking control over their own learning is that their work to develop this capability in their pupils had its roots according to Teacher 3
in their earlier experiences as a language teacher. It may be therefore that important dimensions of this teacher’s identity as a language teacher lie at the core of their chemistry teacher identity. That Teacher 3 describes working more as a language teacher in the past supports this hypothesis. Indeed, such an idea asks us to wonder how a teacher’s ‘other subject’ actually impacts their teacher identity formation, and whether having two subjects that are not closely related academic disciplines (which is the case for this teacher) might not force one to forge a teacher identity that enables a ‘reaching across’ of unrelated disciplines. Indeed, might this not itself be an underlying mechanism for the teacher’s Bildung? Irrespective however of whether this may or may not be the case, we argue that the impact of this teacher’s ‘other subject’ is to marginalise their Bildung-related didactic work in their chemistry teaching. Perhaps one insight that we can bring with us from this discussion therefore is that Bildung, being a latent possibility in all people, needs to be nurtured and supported if it is to become a source of one’s didactic exploration as a teacher. Importantly, one crucial source of such nurture and support can be through teacher training itself being built upon a Bildung-related didactic praxis. In his book, ‘The Master and his Emissary’ Iain McGilchrist warns that contemporary Western societies, through how they shape their societies, perpetually reinforce ‘left-brain primacy’ mindsets, leaving ‘right brain primacy’, the mindset crucial to our being engaged in a relationship with the living world and living things in that world, in a perpetual state of marginalisation. Importantly, McGilchrist’s warning can explain to us why economic goals as manifested within the Swedish school education system marginalise the curriculum’s humanistic or Bildung goals. It can also explain to us why teachers themselves, through ‘implicit’ factors, marginalise Bildung. In the introduction to this work it was noted that Bildung may be of crucial importance to both the degree of meaningfulness pupils experience in relation to their learning and to the health and sustainability of human democracies. The results of this study show however that for the three participating teachers both contextual factors as well as factors personal to each teacher marginalise Bildung in their teaching. One crucial pathway to elevating Bildung in teacher’s teaching is to nurture and support teachers in becoming actively engaged in a Bildung-related didactic praxis, something which can be most powerfully achieved through teacher training itself being built upon a Bildung-related didactic praxis.
6.6. Implications of this work and future research

This study employed a qualitative research design in which a semi-structured interview was administered to three experienced teachers who taught chemistry in Swedish gymnasium schools in Southern Sweden. As has already been established, the external validity of this study is limited. Despite this limitation, in discussing the implications of this work it is necessary however to conceive that the results of this study will likely have relevance to Swedish gymnasium school chemistry teachers generally, and possibly, to teachers in Swedish gymnasium schools who teach other natural science subjects as well. In light of this study illuminating the presence of ‘implicit’ factors, that is, factors that are a part of teachers themselves that are outside of their awareness, and which limit teacher’s potential for engaging in a Bildung-related didactic praxis in their chemistry teaching, the major implication of this work is that this result represents a call for higher educational institutions to more deliberately foster a Bildung-related didactic praxis (a Bildung-Didaktik) in trainee chemistry teachers. In our view this is most powerfully achieved through teacher training itself being built upon a Bildung-related didactic praxis or Bildung-Didaktik. Importantly, such a way of working needs to be informed by research. One possible avenue to explore in this regard is through the operationalising of the ‘Bildung-orientation’ construct. There are two crucial avenues that can be explored through operationalising this construct. Firstly, it would permit a large-scale questionnaire assessment of Swedish school teacher’s orientation to promoting Bildung in their (chemistry) teaching. Secondly, it could form the basis for trainee teacher’s self-assessment of their own Bildung-orientation and thus aid in their development of a reflective awareness for the different factors that can marginalise Bildung in their (chemistry) teaching.
7. References


Eldritch, Michael (2004). The German Bildung tradition. Course notes. Department of Philosophy. UNC Charlotte, USA.


Appendix 1

Teacher Bildung-orientation Interview

The teachers’ vision for teaching (in general and as a teacher of chemistry)

Almost all teachers will at some point in their careers have formulated for themselves a vision for their teaching; in terms of what it is they want their pupils to learn and what value they want the knowledge learned to have for their pupils in their lives.

- On a general level, what is your vision for teaching? That is, what do you want your pupils to learn through their schooling?
- What value do you want the knowledge your pupils learn to have for them in their lives?
- Now I want to ask the same questions, but specifically in terms of teaching chemistry.
- What is your vision for chemistry teaching? That is, what do you want your pupils to learn through your chemistry teaching?
- What value do you want the knowledge your pupils learn in chemistry to have for them in their lives?

The teachers’ didactics-praxis

The chemistry teacher’s didactic praxis involves making decisions about what you want your pupils to learn, how those learning goals are to be reached, reflecting both during and following lessons about what worked, what didn’t work, and revising your teaching practices so as to better reach your teaching goals.

- In your didactic praxis, what choices do you make in terms of realising your vision for teaching, specifically regarding what it is you want your pupils to learn?
- Can you give an example of when you have made such a choice?

If a discrepancy exists between the interviewees vision for teaching and the choices they make in their didactic praxis:

- What in your view are the reasons that there is a difference between your vision for teaching and the choices you make in your teaching reality?
Appendix 2

Teacher 1: Analysis of teacher’s vision for their teaching

Analysis of the vision of Teacher 1 for their teaching in terms of what the pupil should learn.

- To develop the ability to independently manage one’s own learning*, since the teacher’s job is to prepare pupils for university*\(^{h,k}\)
- Develop a critical and reflective distance towards knowledge one has learned, an ability to make appropriate use of it*\(^{a,b,f}\), with a view to preparing pupils for study in higher education*\(^{h,k}\) as well as problem solving in a future career*\(^{h}\)
- Chemistry knowledge that prepares pupils for a career in which pupils can responsibly participate in society as a collective project, where one important goal of this project is the promotion of sustainability*\(^{e,f}\)

Analysis of the vision of Teacher 1 for their teaching in terms of the value that they want the knowledge their pupils learn to have for the pupils themselves.

- Confer a good natural science bildning, that is, the ability to make one’s world more begriplig, to understand one’s world, one’s daily life, to make informed choices, e.g. in order to improve one’s personal situation*\(^{h,b}\)
- Confer on the pupil the power to get a job/begin a career, conferring therefore the power to survive economically*\(^{h,k}\)
- Confer the ability to understand one’s world, to make it more begriplig. Confer greater security through having knowledge, so that the pupil is more able to have a critical posture towards information in the world and make valuations and judgements regarding it*\(^{a,h}\)

Teacher 1: Analysis of summary of the didactic choices they makes in order to realise their vision for their teaching

What should the pupils learn? - Teacher 1 reformulates the primary goal of their vision as the promotion of deep learning. Despite this, Teacher 1 describes prioritising the teaching of elementary knowledge/core content over the goal of deep learning. Teacher 1 indicates that such prioritising may however be less pronounced in Kemi 2 than in Kemi 1. Teacher 1 also provides an example they believe illustrates pupils having developed over the 3 years of gymnasium school mental capabilities Teacher 1 identifies with in their vision for teaching, that of knowledge providing greater freedom in terms of how one is able to relate to their world*\(^{b,g}\). Teacher 1 nonetheless justifies, on numerous occasions, the need to prioritise the
The teaching of elementary knowledge/core content over ‘more developmental’ goals, like for example critical thinking. Reasons Teacher 1 provides for making such a choice, and which are seen as being beyond their control, include large class sizes, a limited number of available lessons, the course syllabus, national exams, pressure to make sure every pupil passes the course, pupil’s own aptitude for learning chemistry, and a greater measurement and control of pupil’s knowledge. An additional reason provided by Teacher 1, and which is within their own control, is a belief that one must teach elementary knowledge first before one can connect the subject to relevant societal issues and work with problem solving.

What value does the teacher want the knowledge pupils learn to have for the pupils themselves? - Teacher 1 reaffirms their visions for their teaching and describes two distinct dimensions as representing the value they want learning to have for their pupils into two dimensions: Knowledge is of utility to pupils in allowing them to continue their studies and gaining a profession; knowledge has usefulness and meaning outside of both school and different professions, both to the individual in their everyday life as well as to society as a whole. Teacher 1 describes using open questions that link chemistry to questions concerning products/substances in pupil’s every days lives (e.g. are batteries a solution to our environmental problems?), when introducing or framing new subject areas (e.g. electrochemistry). Teacher 1 views open questions as creating a greater level of engagement in pupils. Teacher 1 reveals that their motive for using open questions is to get the pupils to ‘open up’ and become more receptive for learning elementary knowledge/core content. Open questions are seen therefore by Teacher 1 as an effective ‘point of entry’. Teacher 1 expresses a belief that sometimes one must teach subject foundations first before using open questions.
Teacher 2: Analysis of teacher’s vision for their teaching

Analysis of the vision of Teacher 2 for their teaching in terms of what the pupil should learn.

- As much knowledge as possible so that something is left when they finish school[^1] which they can use when studying in higher education[^b]
- Methods one can use to solve natural science problems[^b]
- Ability to independently analyse and reflect over things and discuss with others[^a,b,f]
- Ability to successfully take responsibility for their own studies, to learn ‘study methods’[^a]
- Ability to cooperate with others
- Develop sufficient knowledge so that following school they can contribute to different areas in society and furnish society’s needs[^i,k]
- Chemistry knowledge more or less strictly according to the course syllabus[^j] that persists in pupils[^1], and because there is a shortage of chemists and chemistry teachers, it would be quite fun if some became chemistry teachers[^i,k]

[^1]: These statements are consistent with Klafki’s ideas on ‘educational substance’ as pupils’ understanding of universal truths which they draw from a subject matter. In view however of the interpretation of other aspects of the vision of Teacher 2 there is no reason to believe that Teacher 2 is referring here to knowledge that is transformational or generative for the pupil.

Analysis of the vision of Teacher 2 for their teaching in terms of the value that they want the knowledge their pupils learn to have for the pupils themselves.

- Confer greater security, a stronger voice in society, greater power to influence and change one’s own situation[^b]
- Confer a foundation upon which more knowledge can be built; the bigger the foundation, the easier it is to build upon it[^i]
- That the pupils themselves value the knowledge they are learning as something they can have utility of in the future[^Note 1]
- Based in the course syllabus[^k], a resource for feeling more assured in higher education[^b], a foundation upon which more knowledge can be built[^i]

[^1]: This statement is consistent with Klafki’s understanding of Bildung. It seems more likely however that Teacher 2 is not referring to learning of the transformational/generative kind, but rather, to learning that creates a foundation of knowledge that will have utility when that foundation is built upon in future learning situations.
Teacher 2: Analysis of summary of the didactic choices they makes in order to realise their vision for their teaching

**What should the pupils learn?** - Teacher 2 describes a number of factors that prevent them from realising their vision for their teaching: Limited teaching time, syllabus goals, ‘central content’, the need to go through something new in every lesson. With more time Teacher 2 would invite chemists to speak about their work allowing pupils to build an understanding of how one becomes a chemist and what knowledge in chemistry is used for. When prompted Teacher 2 reiterates their goal of developing in pupils an ability to analyse, reflect and independently use chemistry knowledge in order to solve new problems. Teacher 2 indicates they work ‘in some way’ to realise this goal all of the time and gives examples of how analytical and reflective thinking can be developed, e.g. a group activity using Molymods to learn about dipoles, a laboratory linking the properties of alcohols to their structure, and the giving of formative feedback using questions when marking pupil’s lab reports. Teacher 2 expresses that since every lesson starts with something new, their ability to develop pupil’s analytical and reflective capacity is negatively affected because pupils don’t have time to look closely at what they go through in class. Reflecting on additional factors that prevent Teacher 2 from realising their vision for their teaching, Teacher 2 describes pupils as increasingly wanting instant answers, lacking tolerance for questions requiring a discussion, being less willing to analyse and reflect, and being less inclined to want to memorise chemistry facts.

**What value does the teacher want the knowledge pupils learn to have for the pupils themselves?** - Prompted about their earlier answer regarding pupils having greater power to influence and change their own situation Teacher 2 expresses that they try to vary their teaching, to make it sometimes fun, and to linking chemistry to pupil’s everyday lives in order to make it more interesting. Teacher 2 gives two examples of how make chemistry more interesting by linking it to pupil’s everyday lives: Linking the oxidation of alcohol to how it is broken down in the liver and explaining methanol is poisonous when drunk. Teacher 2 explains however that they don’t have time to make big digressions, but only time for doing ‘small things’. Teacher 2 expresses being ‘a bit bad’ at making chemistry relevant for pupils and that despite having the goal to improve that side of their teaching ‘it just hasn’t happened’. Reflecting on additional factors that prevent Teacher 2 from realising their vision for their teaching, Teacher 2 speaks of pupils’ and parents’ grade fixation,
something which Teacher 2 says negatively affects Teacher 2 because of the demand placed upon them from multiple parties that every pupil should pass the subject. Teacher 2 also speaks about a discourse existing in which teacher’s salaries are connected to the results pupils achieve. Following the interview, Teacher 2 speaks about how some pupils are themselves resources that are wasted.

Teacher 3: Analysis of teacher’s vision for their teaching

Analysis of the vision of Teacher 3 for their teaching in terms of what the pupil should learn.

- Partly, to learn subject knowledge, that being what the teacher is bound to do
- Develop, through promoting a critical self-analysis of one’s earlier learning approaches, effective strategies for having greater autonomy regarding one’s learning, that allows one to build greater resilience to setbacks and makes one more likely not to avoid choosing subjects that are more difficult when studying in higher education; which is what gymnasium education is primarily preparing one for; or learning in a future job
- To develop a natural scientific approach that can give pupils a tool in their future studies, even outside of chemistry

Note 1 This statement seems to negate ‘capacity for reasonable self-determination’ as a fundamental dimension of Bildung as described by Klafki in regard to Teacher 3 themselves. This, however, would be an incorrect interpretation of this part of the vision of Teacher 3. Crucial in this regard is the word ‘partly’. In view of the full vision of Teacher 3, this statement must be seen as an expression of not wanting to neglect their professional duty despite their vision for their teaching stepping away from the learning of subject matter as the primary focus of their teaching vision.

Note 2 Teacher 3 asserts in the interview that this is their overriding vision for their teaching.

Analysis of the vision of Teacher 3 for their teaching in terms of the value that they want the knowledge their pupils learn to have for the pupils themselves.

- Confer the ability to critically review/analyse the truth content of information
- Wake an intrinsic curiosity and desire for learning; achieved through subject content being made relevant and the teacher making the most of pupil’s questions and creativity within the subjects. An intrinsic curiosity and desire for learning opens the door to pupils studying subjects they brinner för and opens the pupil to trying different things, even when there is a risk of failing
- Confer a critical posture to one’s world. Confer a natural science perspective, that is, an understanding for the methods that underlie scientific claims (including being aware that there are no theory-free observations), how one presents scientific results, and how scientific knowledge evolves
Teacher 3: Analysis of summary of the didactic choices they makes in order to realise their vision for their teaching

What should the pupils learn? - Teacher 3 explains that a core aspect of how they work is to develop in pupils capabilities that they can use in future studies (or work) that are not bound to a particular subject of instruction. Teacher 3 explains that a central aspect of their work is to wake a reflective awareness in pupils that success in learning is wholly dependent upon the learning strategies one uses. Teacher 3 uses the term ‘fixed mindset’ to describe how pupils can create barriers by thinking in certain ways about their learning. Teacher 3 describes their work to help pupils escape ‘fixed mindsets’: First pupils need to become aware of their thinking. Then pupils analyse their past learning strategies to better understand what they need to do in future in order to better succeed. Teacher 3 expresses the belief that pupils developmental potential increases significantly if they see themselves as active in their own learning. Teacher 3 describes formative assessment and the giving of continual feedback as vital to helping pupils take control over their own learning. Teacher 3 describes basing their teaching on discovering ‘where the pupils are’, and that a core strategy of theirs is finding assignments for the pupils that allow Teacher 3 to know ‘where they are’. Here Teacher 3 describes building such assignments around aspects of the subject content that are crucial for knowledge development. Teacher 3 gives examples of how pupils are able to take control of their own learning: Pupils are given the main responsibility for defining constructs that are important to a course theme, something which they have the opportunity to renegotiate over time; pupils are allowed to design the questions to tests; pupils evaluate themselves regarding where they think they are according to the course criteria, what strategies they have used to get where they are, and what they need to change to get to where they want to be. Teacher 3 uses the theme of chemical bonding to describe a specific example. Teacher 3 describes an important aspect of teaching in the natural sciences is helping pupils develop strategies for dealing with/working with natural science texts. Teacher 3 explains their way of teaching as being closer to a language development focus (developing the ability to read natural science texts, differentiating between different constructs, developing the ability to obtain knowledge independently), than a ‘content teaching’ focus.

What value does the teacher want the knowledge pupils learn to have for the pupils themselves? - Teacher 3 describes developing an intrinsic curiosity and desire for
learning as one of the most difficult capacities to develop. Teacher 3 expresses the belief that linking chemistry to pupils everyday lives is key to developing this capability. Teacher 3 also explains that including this dimension in their teaching, and including context that is relevant to pupils, is the biggest challenge. Teacher 3 gives reasons for this being the case: The course’s ‘central content’; the work of Teacher 3 to concretise for the pupils what it is they need to do in order to reach higher criteria for the course; and pupil’s strategic thinking regarding their achieving of a certain grade. Teacher 3 gives two examples of how they work to develop an intrinsic curiosity and desire for learning: Beginning a new course theme with a discussion question that pupils will not be able to answer, e.g. why does an egg become hard when boiled but a potato soft?, and then returning to the same question at the end of a course theme, giving the pupils the opportunity to see that they are now able to see the connection of the science knowledge with their every day experiences; giving pupils the task of solving real world ‘cases’ which gives them the opportunity to see that their knowledge can be applied in real world situations. Teacher 3 then gives an example of how they work to develop pupil’s critical posture: A ‘history of ideas’ project pupils work with throughout their chemistry course concerned with how ideas within the natural sciences are bound to different periods in history, and developing in pupils an understanding for how ideas of what it is that is ‘true’ are bound to one’s place in history. Teacher 3 describes seeing a big change in pupils regarding their taking control of their learning. Teacher 3 gives an example of being able to see this: At the end of a course pupils self-evaluations of their strengths and weaknesses closely match the evaluations Teacher 3 has for those pupils.
### Appendix 3

Profiles of teacher’s orientations to promoting Bildung in their chemistry teaching

<table>
<thead>
<tr>
<th>Bildung-orientation</th>
<th>Vision for their teaching -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher 1</strong></td>
<td>To promote pupil’s Bildung; though the utility the teacher sees Bildung-related capabilities as conferring is largely aligned with an economic view of education.</td>
</tr>
<tr>
<td></td>
<td>Choices teacher reports making to realise their vision - Teacher’s Bildung-orientation is unrealised due to economic goals (as contextual factors); teacher’s SOD approach; teachers’ linking of chemistry to pupils lives in order to serve a SOD approach; and the examples they give when linking chemistry to pupils lives being at best consistent only with Sjöström level 2.</td>
</tr>
<tr>
<td><strong>Teacher 2</strong></td>
<td>Considerably marginalised, possibly non-significant.</td>
</tr>
<tr>
<td></td>
<td>Choices teacher reports making to realise their vision - Bildung ‘as a developmental possibility’ is marginalised due to economic goals (as contextual factors); teacher’s low degree of intentionality regarding their Bildung-related didactic work; and the examples they give linking chemistry to pupils everyday lives being consistent only with Sjöström level 1.</td>
</tr>
<tr>
<td><strong>Teacher 3</strong></td>
<td>To promote pupil’s cognitive Bildung, which for this teacher is an orientation towards Bildung that is (in regard of what they believe pupils should learn through schooling) ‘greatly’ aligned with an economic view of education.</td>
</tr>
<tr>
<td></td>
<td>Choices teacher reports making to realise their vision - Teacher succeeds in promoting the development of a capability that is related to Bildung, though there is a strong basis for viewing this as resulting from a cognitive Bildung orientation that is ‘to a great extent’ not oriented to promoting Bildung. Also, the development of the capacity most strongly related to Bildung in this teacher’s vision is marginalised due to economic goals (as contextual factors); the teacher de-prioritising this capacity in their Bildung-related didactic work; and the examples they give linking chemistry to pupils lives being consistent only with Sjöström level 1.</td>
</tr>
</tbody>
</table>