



# Factors associated with school participation among students with hearing loss

Ann Mette Rekkedal

Institute of social work and health science, Norwegian University of science and technology, Trondheim, Norway

## ABSTRACT

The aim of this study is to explore teachers' views on school participation of students with hearing loss (HL) and to examine the association between students' school participation and factors related to the framework of the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY). A total of 167 teachers participated in the study. Structural equation modelling was performed to explore relationships among the factors. The teachers considered the students to be socially included and to participate academically almost at the same level as their typical classmates. A multifaceted interaction between ICF-CY factors and students' participation in academic activities was found. Personal factors such as 'academic skills and motivation' explained most of the variance in academic participation, and were also associated with activity and environmental factors. Efforts to understand their classmates directly and indirectly associated with academic participation. Students with mild and severe HL appeared to have same level of participation rate. The parents' involvement in their children's schooling and the use of amplification systems were related to academic participation but not to social participation. A few factors associated with social participation; in those cases, having other disabilities in addition to HL explained most of the variance.

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## KEYWORDS

Hearing loss; inclusive schools; participation

## Introduction

This study examines teachers' views on school participation among students with hearing loss (HL) in inclusive schools. The study is part of a larger research where both teachers' and students' perspectives on use of assistive hearing technology and school participation are explored.

The establishment of inclusive schools and new cochlear implant (CI) technologies have resulted in that the majority of children with HL in Norway are attending local schools. To ensure an inclusive education, the schools are obligated to make adaptations according to each individual's abilities and interests. Nevertheless children with disabilities have a lower participation rate in school activities compared with children without disabilities. This lower rate of participation is less pronounced in teacher-led activities than in unstructured school activities (Eriksson and Granlund 2004). Students with HL are reported also to participate less in classroom communication because of their hearing impairment (Ohna 2004; Punch and Hyde 2010). Academic activities are formal and structured and involve rules or goals; have a formal leader, coach, or instructor; and often require advanced planning. This may explain why students with disabilities have a higher participation rate in academic settings than in social activities. Social activities are informal and spontaneous in nature and are regularly initiated by children (King et al. 2006), and may not be so easy to adapt compared to academic

activities. However studies have shown that participation in educational settings is positively related to social relationships with peers (King et al. 2006; Dammeyer 2010).

Full accessibility to language and communication is fundamental to being able to actively participate and experience positive social development (King et al. 2006; Dammeyer 2010; Antia, Reed, and Shaw 2011). If the students' abilities to perceive communication is poor, their classroom participation and social participation will be negatively affected (Antia et al. 2011). In particular, the ability to understand classmates is essential (Antia, Sabers, and Stinson 2007). The listening environment in the classrooms is therefore of importance.

Participation restrictions that students with HL experience in daily life can depend on a variety of factors. The present study applies the International Classification of Functioning Disability Health for Children and Youth (ICF-CY) model to examine how different factors are associated with school participation. The ICF-CY provides a system of coding and documenting bodily functions and the relationships between contextual factors and individual functioning. A person's functioning and disability is conceived as an interaction among health factors; environmental factors, personal factors, activity and participation. Applying the ICF-CY model can increase researchers' and clinicians' knowledge about potential factors that may be related to students' participation and may provide a broader picture of the interrelationships among these factors. Knowledge about how the factors operate together to enhance or limit participation is essential for planning interventions to enhance school participation among students with HL.

Environmental factors refers to the physical, social and attitudinal environment in which an individual lives (WHO 2001). Amplification systems that transfer teachers' and classmates' voices to students' hearing aids or CI through an inductive loop or frequency modulation (FM) significantly improve students' listening perception (Berndsen and Luckner 2012). An Australian study revealed that few children with CI participated independently in school without assistance; however, when they were supported with amplification systems, a note taker or an interpreter, they participated independently to the same degree as other children (Punch and Hyde 2010). Craddock (2006) found that students with disabilities, including HL, improved their academic participation with assistive technology and could also academically outperform other students (Craddock 2006). Regardless, both studies mentioned only teacher microphones and not handheld microphones used by hearing classmates. Handheld microphones are common equipment for Norwegian students with HL in ordinary schools, with one or two hearing classmates typically sharing a single microphone. The importance of those microphones has been minimally explored, but may be related to the students' participation rate.

The teachers are responsible for implementing microphones in the lessons. Rekkedal (2014) revealed that teachers of students with mild HL seldom adapted their teaching or implemented microphones, whereas teachers of students with severe HL regularly implemented microphones and adapted their teaching. Teachers of students with mild HL also reported less knowledge about hearing impairment compared to teachers of students with severe HL, which was related to the usage of microphones. (Rekkedal 2014). The level of support available is described to be a more pragmatic and holistic determinant of classroom performance than the students' level of HL (Antia et al. 2011). Negative attitudes and insufficient adaptations are hindering environmental factors (Mittler 2004). The teachers' willingness to implement microphones and make necessary adjustments is therefore of importance. Some teachers do not want to teach children with HL because they do not have the necessary skills and are overloaded or do not get enough support in their work (Berndsen and Luckner 2012). They may be hesitant to teach pupils with HL because it includes the use of microphones. In addition, teachers and schools define and organize inclusive schools differently. Jenssen (2011) revealed that the majority of Norwegian teachers practices inclusive teaching as segregated teaching, whereas the minority of the teachers viewed inclusive teaching as an adapting of the general teaching. These different views may have implication for the schools' inclusive practice.

The use of special education resources and teacher assistants has been associated with students' participation at school. These interventions are found to present a barrier to participation for students

with disabilities (Wendelborg and Tøssebro 2010). Students with HL who spend more time outside the general classroom participate less in social activities with their classmates (Antia, Reed, and Shaw 2011).

Class size is another environmental factor critical to the listening condition. Small classes are recommended because having a large number of students in a classroom increases problems with noise.

Furthermore, family support is central (Eriksson and Granlund 2004; King et al. 2005); parental involvement in school is associated with greater success in the form of developing academic skills and social competence (Antonson, Danermark, and Lundström 2006).

The ICF factor; bodily functions and structures concern cognitive and physiological functions. Here it concerns the students' degree of HL and additional impairments or difficulties. Some studies report that students with mild HL have poorer school outcomes than students with severe HL (Most 2004). Other studies cannot find differences between students with mild and severe HL (Convertino et al. 2009). Though, disabilities that include several impairments in addition to HL strongly increase children's risk of encountering problems in school (Brunnberg, Bostrom, and Berglund 2008).

Personal factors are undefined in ICF, but may include race, gender, age, other health conditions, lifestyle, habits, upbringing, coping styles, social background, education, profession, past and current experience, overall behaviour pattern, individual psychological assets and other characteristics that may play a role in disability at any level (WHO 2001). According to the literature personal factors such as sex and age have implications for students' school results. Several studies report that male students have poorer school results than female students (Nordahl et al. 2011; Hendar 2012). A Canadian study revealed that female students with HL exhibited increased social participation if they participated more in their classes; however, this difference was not found among male students (Musselman, Mootilal, and MacKay 1996). Younger students with HL are reported to have more positive relationships with their hearing peers than adolescents with HL (Wauters and Knoors 2008). In contrast, Antia et al. (2011) could not find this association.

Personal factors also include psychological characteristics. An individual's autonomy, self-efficacy and locus of control are reported to be better predictors of participation than environmental factors (Almqvist and Granlund 2005; Clarke et al. 2011). Children with severe communication disabilities, who rated their self-efficacy as high, reported high levels of participation in school activities (Clarke et al. 2011). Students who reported lack of confidence and ability, poor study habits and low motivation tended to perform poorly (Albertini, Kelly, and Matchett 2012). On the other hand, they who were assessed as having their strength in study habits, verbal confidence and desire to finish college were significantly associated with academic performance. Since all of the students were at a College for the Deaf the listening environment should be more or less satisfactory. Personal characteristics that are considered important for social participation include an outgoing and friendly nature, a positive attitude, optimism and resilience (Oberle, Kimberly, and Kimberly 2010). In addition, students' opportunities to interact with peers with similar HL have consequences for their social participation rate (Brunnberg 2010). Interactions with hearing peers are considered more challenging and are characterized as vertical relationships, whereas interactions with children with similar disabilities are characterized as horizontal relationships.

The final two domains are Activity and Participation. Activity is defined as an individual's execution of a task or action, and Participation describes an individual's involvement in life situations (WHO 2001). However, only one classification system for these components is provided. No standardized method for using activity and participation parameters exists, and this omission has been criticized (Whiteneck and Dijkers 2009). In accordance with the ICF-CY (WHO 2001) and Whiteneck and Dijkers (2009), activity is interpreted here as the execution of an act and as the performance at an individual level. Acts concern general abilities (such as basic learning, listening and speaking), which are guided by maturation and do not necessarily depend on a specific situation. Participation in academic activities and social interactions with peers is classified as involvement in life situations and performance at the societal level.

All of the ICF-CY factors are connected via bi-directional links that illustrate potential interactions. A number of potential interactions may occur (Ravenek et al. 2012). No causal relationships of any type can be posited among the components; at most, they identify potential associations that may be empirically demonstrated in particular cases. However, studies have explored causal relationships among the factors (Hwang et al. 2014). Danermark states in an unpublished article that this causal agnosticism is a strength because it leaves the question of causality completely open to empirical research. It is a weakness that has been criticized because it means that the ICF is theoretically underdetermined.

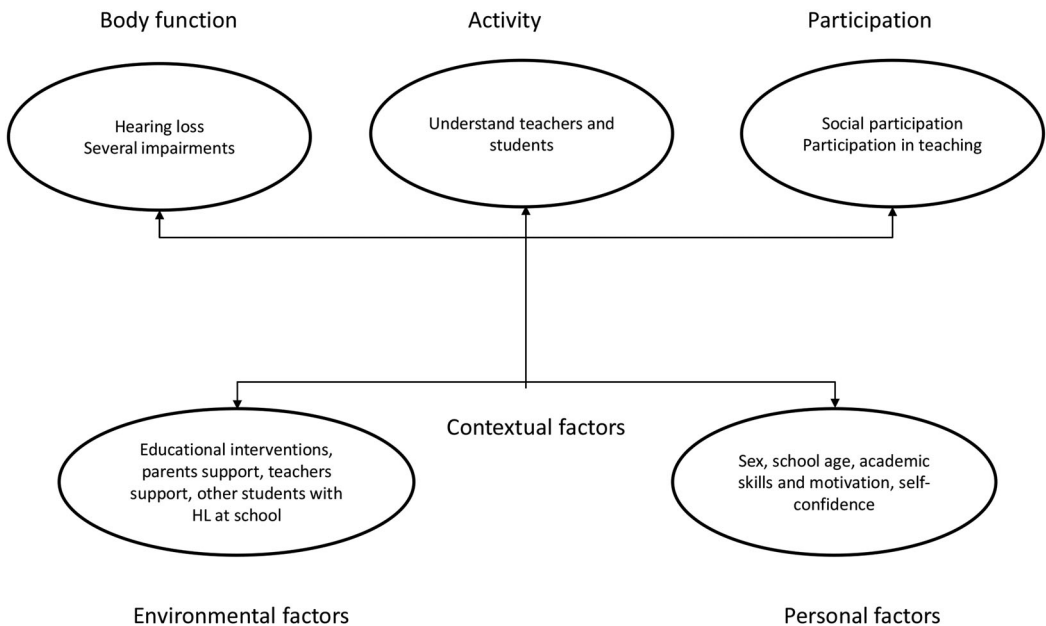
### Aim and research questions

The aim of this study is to examine how the teachers view the school participation of students with HL and to explore the relationship between ICF-CY factors and participation in academic and social activities. The study addressed the following research questions: (a) How do students with HL participate in academic and social activities? (b) How are the ICF-CY factors related to students' participation in academic and social activities?

### The model of analysis

The ICF-CY model presented in Figure 1 illustrates the dependent variables and outlines the mechanisms by which children's participation is thought to be directly or indirectly enhanced, but does not incorporate health conditions. The teachers' observations and opinions of students' academic and social participation were examined and measured. Academic activities are formal and structured, whereas social activities are informal activities regularly initiated by children (King et al. 2006). The distinction between these two activities may indicate that different factors are related. However, an equal number of factors was measured for both activities.

Students' understanding of classroom communication is characterized here as an automatic act, and assumed to relate to their levels of school participation.



**Figure 1.** The ICF-CY model with the specific factors measured.

The use of microphones is anticipated to be positively associated with participation because it significantly improves students' listening perception (Ricketts and Galster 2008). Being removed from the classroom for instruction is considered to be negatively associated with participation. Family support is anticipated to be positively related to school participation.

The level of HL is hypothesized to be associated with the students' perception of classroom communication and participation in school activities: further to be related to environmental factors such as the type and frequency of educational interventions.

Personal factors are not defined or measured in the ICF-CY, even though they do influence an individual's functioning (WHO 2013). The present study measured such personal factors and included them in the analysis.

## Methods

The sample included 167 teachers of students who attended regular classes from the 5th to 10th grades. Some few teachers (10%) reported to also use some sign language in the lessons. In total, 78% of the students were the only student with HL in the class, and the teachers completed a survey pertaining to each student. The students had unilateral or bilateral mild to profound HL, and 18 of the students used Cochlea Implant. The majority of the students received their first hearing aids (48%) or CI (61%) at the age of 3–5 years. A large group of 40% received their hearing aids first after school age. About 30% did not use any personal amplifications. The distribution of the students' HL is presented in Table 1.

Twelve assistive technology centres that provide assistive technologies free of charge to people with disabilities and four national resource centres for hearing disabilities assisted with recruitment. The centres distributed informational letters to the parents of 554 identified students with HL and requested permission to contact the children's teachers. A total of 187 (34%) parents provided consent for the children and teachers to participate. No data were available for the children who did not participate; therefore, it was difficult to perform a non-responder analysis. Of the 187 teachers who were contacted, a total of 167 participated in the survey, reflecting a relatively high participation rate. The responses to the survey were provided either on paper or online. Approximately 80% of the teachers responded on paper.

The majority (68%) of the teachers were women aged between 31 and 50 years. Approximately 28% had taught the student with HL for less than one year, 36% had taught the student between one and two years, and 36% had taught the student for more than two years. It is a standard practice that Norwegian teachers teach their classes for several years in contrast to for instance teachers in the North America. Few teachers (12%) were followed up monthly by a hearing therapist. About 38% were followed up once or twice yearly whereas 50% were more seldom or never followed up by a hearing therapist. The majority (90%) of the teachers were supplied with teacher microphones. About 74% of these also had microphones for the hearing students. In total, 62.5% of them had a high density of student microphones (i.e. one or two students shared one handheld microphone). In the other cases, three to seven classmates shared one microphone.

## Ethical considerations

The Norwegian Data Protection Official for Research approved the study. The participants were informed that the study was anonymous and that they could leave the study if and when they wished.

## Measures

The measurement consisted of more composed questions than of standardized questions. All of the measurements were subsequently linked to ICF-CY categories and are presented in Table 1.

**Table 1.** The ICF-CY categories and measurement used in the article.

ICF-CY categories	Measurements
Dependent variables	
Participation	
d355 Discussion	<ul style="list-style-type: none"> <li>The pupil participates in classroom discussions (Long, Stinson, and Braeges 1991; Antia, Sabers, and Stinson 2007)</li> </ul>
d350 Conversation	<ul style="list-style-type: none"> <li>How actively does the student participate in class discussions/conversations compared to the average of the classmates?</li> </ul>
d160 Focus attention	<ul style="list-style-type: none"> <li>How attentive is the student towards class discussions/conversation compared to the average of the classmates? (less, slightly less, equal to, slightly more, more)</li> </ul>
d8201 Classroom activities	<ul style="list-style-type: none"> <li>How actively does the student I participate in the teaching compared to the average of the classmates?</li> </ul>
d160 Focus attention	<ul style="list-style-type: none"> <li>How attentive is the student I towards the teaching compared to the average of the classmates? (Less, slightly less, equal to, slightly more, more)</li> </ul>
d750 Forming relationships	<ul style="list-style-type: none"> <li>To what extent is the student socially included with classmates or peers during breaks (to a slight degree, to some degree, to a great degree, or unsure) (Ytterhus and Tøssebro 2005)</li> <li>To what extent is the student socially included with classmates or peers during the lessons?</li> <li>How do you think the student perceived herself/himself in relation to peers in the class? (Lonely, involved, but slightly in the periphery, included) (Ytterhus and Tøssebro 2005)</li> <li>How often does the student participate in activities during breaks compared with the average student of the class (less than, equal to, more than)</li> <li>Does the student have friends at school? (None, has one friend, or has many friends)</li> </ul>
Independent variables	
Activity	
d150 Listening	<p>Classroom participation questionnaire (Long, Stinson, and Braeges 1991; Antia, Sabers, and Stinson 2007):</p> <ul style="list-style-type: none"> <li>Understand teachers</li> <li>Understand classmates</li> </ul>
Body function	
b230 Hearing function	<ul style="list-style-type: none"> <li>Degree of HL (Hendar 2008)</li> </ul>
Environmental factors	
e1251a assistive technology that improves listening perception	<ul style="list-style-type: none"> <li>How often are, respectively, teacher- and pupil-microphones used when you teach the whole class?</li> <li>How often are, respectively, teacher- and pupil-microphones used during class discussion/conversation?</li> <li>(Never, seldom, sometimes, almost always, or always)</li> </ul>
e5853 special educational support	<ul style="list-style-type: none"> <li>How often is the student taught outside the classroom?</li> <li>How often is the student assisted in the classroom? (three to four hours a day, one to two hours a day, three to four hours a week, one to two hours a week, two to three hours a month, or less)</li> </ul>
e5858 Education and training services, systems and policies, other specified	<ul style="list-style-type: none"> <li>How many students are there in the class?</li> </ul>
e310 Family support	<ul style="list-style-type: none"> <li>To what extent are you satisfied with the parental follow-up of, the student's academic performance</li> <li>To what extent are you satisfied with the parental follow-up of, the student's social performance? (To no degree, to a small degree, to some degree, to a high degree, or to a quite high degree)</li> </ul>
e325 Acquaintances, peers, colleagues, neighbours and community members	<ul style="list-style-type: none"> <li>Are there other students with HL in the class?</li> <li>Are there other students with HL at the school (yes, no)</li> </ul>
Personal factors	
Psychological characteristics	<ul style="list-style-type: none"> <li>How motivated is the student to succeed at school?</li> <li>What is the student's ability level compared with his or her classmates?</li> <li>What is the student's effort in school? Retrieved from Nordahl (2005) study</li> <li>What is the student's level of autonomy/independence at school?</li> <li>What is the student's level of self-confidence at school?</li> <li>What is the student's level of safety at school? (Quite low, low, middle, high, or quite high)</li> </ul>

According to the guidelines, each meaningful concept should be linked to the most precise ICF category. And if a meaningful concept of an item is explained by examples, both the concept and the examples should be linked (Cieza et al. 2005). We attempted to follow these guidelines.

### Dependent variables

'Social participation' consisted of measurements linked to *d750 Forming relationships* and *d9100 Social activities*, as Table 2 shows. 'Academic activities' consisted of the measurements linked to *d355 Discussion*, *d350 Conversation*, *d8201 Classroom activities* and *160 Focus attention*.

### Independent variables

'Understands teachers' and 'Understands students' represent category *d150 Listening*. Both variables were measured using a Likert scale. 'The student participates in classroom discussions' was redrawn and measured as participation in teaching activities because it did not actually measure the students' listening perception.

Bodily function is represented by *b230 Hearing function*, which was based on a self-assessment used by Hendar (2008). The variable was transformed into a dichotomous variable (0 = can hear without HA; and 1 = can hear with HA/CI). In addition, the data for students with additional disabilities were collected and are presented in Table 3.

The use of teacher and classmate microphones was linked to *e1251 Assistive technology that improves listening perception*. These two items were combined into a single factor with a Cronbach's alpha of .96. 'Class size' represented *e5858 Education and training services, systems and policies, other specified*. Two items represent *e5853 Special educational support*. The items were combined into one factor with a Cronbach's alpha of .66. *E310 Family support* was represented by two items that were combined into a single factor with a Cronbach's alpha of .889. Two variables were linked to *e325 Acquaintances, peers, colleagues, neighbours and community members*. Two personal variables were examined: the students' sex (0 = male and 1 = female) and school grade (0 = secondary school and 1 = primary school). Personal variables also included measurements of students' psychological characteristics, which are provided in Table 2. The principal component analysis suggested two significant factors (eigenvalues = 3.5; 1.2, % variance = 59.0; 20). 'Academic skills and motivation' represent the first four items, with a Cronbach's alpha of .898. The two final items formed the variable 'self-confidence', with a Cronbach's alpha of .770.

### Analysis

Version 18.0 of the SPSS (SPSS Inc., Chicago, IL, USA) software package and AMOS 18 were used for the statistical analysis. The statistical significance was set at  $p = .05$ . A principal component

**Table 2.** Distribution of the students' HL (% ,  $N = 167$ ).

Can hear speech without hearing aids at a distance of one metre	58.9
Can hear speech with hearing aids/cochlea implant at a distance of one metre	30.4
Cannot always hear speech with hearing aids/cochlea implant at a distance of one metre	10.1
Cannot hear speech with hearing aids/ cochlea implant at a distance of one metre	0.6

**Table 3.** Distribution of the students' impairments (% ,  $N = 167$ ).

Only HL	70.4
HL and severe reading and writing difficulties	9.5
HL and severe behavioural difficulties	3.6
HL and visual disabilities	4.7
HL and mobility disabilities	2.4
HL and more than two impairments	9.5



analysis was performed to evaluate the data reduction of the students' psychological characteristics. The Cronbach's alpha was computed to estimate the internal consistency of the instruments used. A one-way repeated measures Analysis of variance (ANOVA) was used to explore differences in the students' ways of participation in teaching activities. Structural equation modeling (SEM) was used to evaluate the pathways of the ICF-CY framework using AMOS. Only manifest variables were used. The sufficiency of the model fit was tested using standardized fit statistics: the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) (Bentler 1990). These indices test how well the estimated covariance matrix of the model presented reproduced the observed population covariance matrix (Ullman 2006). A good-fitting model is indicated by values at or above .90 for the GFI, AGFI and CFI and values below .05 for the RMSEA. The recommended number of samples for SEM models should have a subject-to-parameter ratio of 4:1 to 6:1 (Bentler and Chou 1987). The model in this study specified 29 free parameters for participation in teaching and 31 free parameters for social participation. Applying a ratio of 5:1 would result in a required sample size ranging from 145 to 155; the sample consisted of 167 teachers.

### Data screening and collinearity diagnostics

Data screening revealed negatively skewed data concerning the variable 'social participation' (standardized scores of skewness =  $-1.247$ ), but the variable was not transformed. A structural analysis of the collinearity diagnostic of the variables included in the SEM analyses indicated no collinearity of the variable (tolerance: .84–.95; VIF: 1.04–1.18). The results of the Durbin–Watson test were well within the boundaries for acceptance (Durbin–Watson = 1.96), and the interpretation residuals provided no reason for concern (Cook's distance < 1).

## Results

The findings are presented in three steps: (a) descriptive statistics of the students' school participation, (b) descriptive statistics and the correlations among the variables and (c) the structural equation model of participation in teaching activities and socially.

### Descriptive statistics of the students' school participation

Table 4 provides an overview of the descriptive statistics of the variables. The variable participation in academic activities comprised *the items being attentive towards and actively participating* in either teacher-led activities or class discussion. A one-way repeated measures ANOVA was conducted to compare scores on the participation construct. There was a significant difference between the two forms of participation

(Wilks' Lambda = .89,  $F(1, 16) = 18.93$ ,  $p < .0005$ , multivariate  $\eta_p^2 = .10$ ). The teachers rated the students to be slightly more attentive towards teaching activities compared with their average classmate and to be slightly less actively involved in teaching activities compared with their average classmate. The participation construct was not divided into passive and active forms. Significant differences were also found between the participation of students with HL in teacher-led activities and their participations in class discussions (Wilks' Lambda = .92,  $F(1, 16) = 13.90$ ,  $p < .0005$ , multivariate partial eta squared = .08). The students participated to almost the same extent as their average classmate in teacher-led activities. In class discussions, the students participated slightly less than their average classmate.



### Correlations between variables

Table 4 provides an overview of the bivariate relationships between the independent variables and the dependent variables of 'social participation' and 'participation in teaching activities'. Three variables (class size, the presence of other pupils with HL in the class and school grade) were excluded from the table and from further analyses because they did not correlate with the two participation constructs. 'School grade' correlated with 'parental involvement' but reduced the fit indices of the SEM model.

The variables 'gender' and 'HL' only correlated with environmental factors and personal factors and were included in the SEM analysis as underlying factors.

The variables 'additional disabilities', 'educational support', psychological characteristics, 'parental involvement', 'understands teachers' and 'understands students' correlated with both of the participation constructs. 'Use microphones' correlated with participation in teaching activities but not with social participation. The variable 'other pupils with HL at the school' correlated with social participation and was included only in the social participation analysis.

### The SEM analyses

Figures 2 and 3 show the path diagram based on the AMOS analyses. Modifications based on theoretical considerations and the suggested modifications made by AMOS produced the modified SEM shown in the figures. The black lines represent the variables with direct or indirect effects on the dependent variables that appear on the right sides of the figures. The dotted line represents non-significant direct effects. The fit indices show an acceptable model fit for the chi-square, RMSEA, GFI, AGFI and CFI tests, as the figures indicate.

Tables 5 and 6 present the total effect of the standardized variables on each other in terms of participation in teaching activities and social participation. The bottom rows show the dependent variables, and the columns indicate the independent variables. Each column is intended to be read from top to bottom.

### Factors associated with participation in teaching activities

Figure 2 shows three factors that are directly associated with the students' participation in teaching activities when controlling for the other variables. 'Academic skills and motivation' ( $\beta = .51$ ) explains most of the variance and exhibits indirect effects, as shown in Table 5. 'Self-confidence' ( $\beta = .18$ ) is positively related but has a smaller effect than academic motivation. 'Understands students' ( $\beta = .34$ ) is directly and indirectly associated with participation in teaching activities.

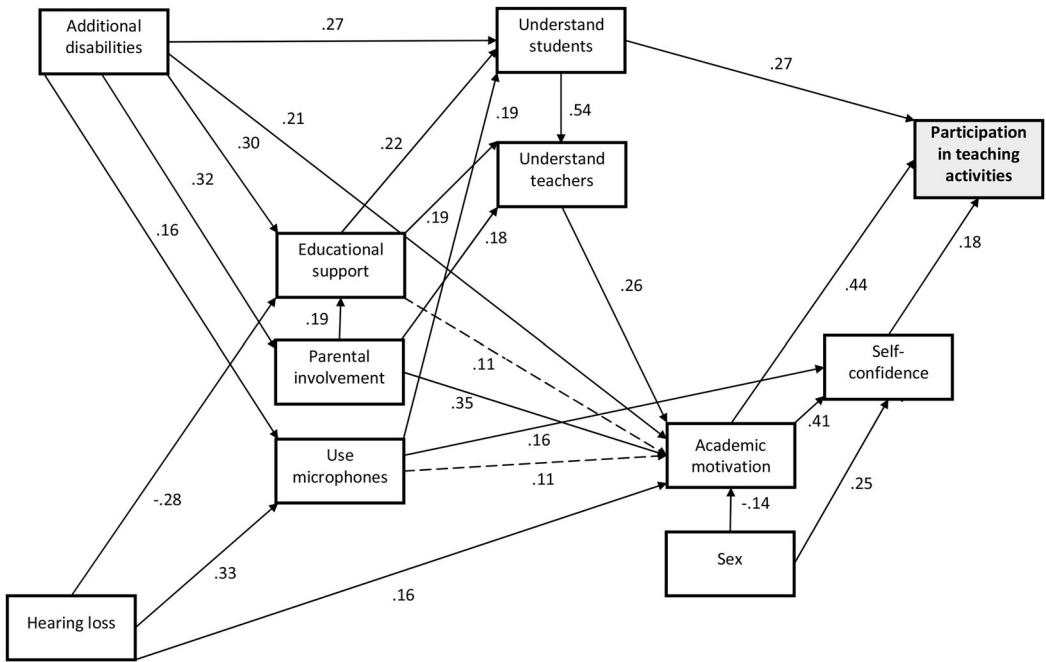
A major pathway appears to be 'additional disabilities' ( $\beta = .35$ ), as Figure 2 shows. This variable is related to 'academic motivation', 'educational support', 'understand students' and 'parents' involvement'. 'HL' indicates a pathway because it is associated with 'academic motivation' ( $\beta = .16$ ), 'educational support' ( $\beta = -.28$ ) and 'use microphone' ( $\beta = .33$ ). Another essential pathway is 'parents' involvement' ( $\beta = .23$ ), which was indirectly associated with participation in 'teaching activities'.

'Understand teachers' ( $\beta = .26$ ) is indirectly associated with the students' participation in teaching activities. 'Educational support' ( $\beta = .20$ ) and 'use microphone' ( $\beta = .14$ ) also show indirect associations. Frequent use of microphones is significantly and positively associated with 'self-confidence' ( $\beta = .16$ ) and the total effects on 'self-confidence' ( $\beta = .22$ ) and 'academic skills and motivation' ( $\beta = .14$ ) increase, as shown in Table 5. The male students show lower academic skill and motivation compared with the female students but have greater self-confidence than the female students. However, the indirect effect of the variable 'sex' becomes approximately zero. The independent variables explain 47% of the variance in 'participation in teaching activities' and 51% of the variance in 'academic motivation'.

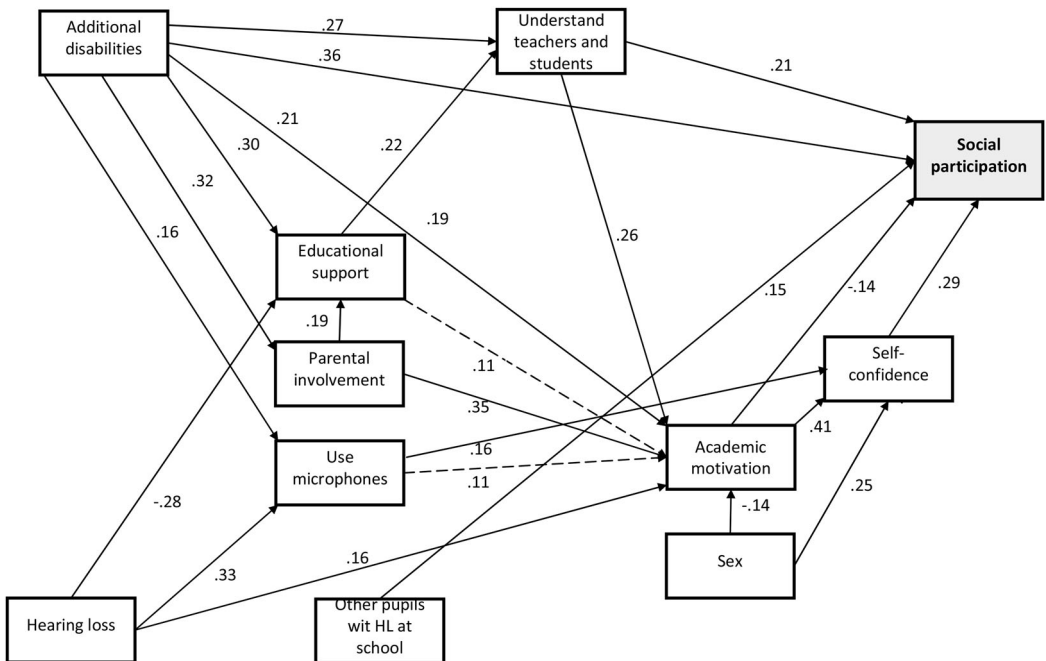
**Table 4.** Summary statistics and intercorrelations for independent and dependent variables.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	<i>M</i>	<i>SD</i>	Mdn	Mode
1 Social participation	.30**	.34**	.36**	.25**	.41**	.06	-.03	.11	.30**	.00	-.18*	-.06	.25**	-.01	.47**	12.45	2.24	14	14
2 Participation academ. activities		.48**	.51**	.62**	.43**	-.04	.05	.22**	.35**	-.05	-.03	-.15	.40**	.12	.31**	14.96	4.21	15	15
3 Understand students			.63**	.40**	.25**	-.00	-.00	.21**	.29**	-.03	-.01	-.02	.29**	-.00	.38**	8.98	1.72	9	9
4 Understand teachers				.51**	.29**	-.05	-.00	.10	.39**	.05	.04	-.08	.38**	-.02	.36**	14.13	1.94	15	16
5 Academic skills and motivation					.41**	-.20**	-.07	.29**	.33**	.00	.10	-.02	.58**	.20**	.48**	13.47	3.35	13	12
6 Self-confidence						.14	.10	.26**	.18*	-.12	-.05	-.03	.18*	.17*	.29**	7.01	1.39	7	7
7 Sex							-.05	-.09	-.07	-.09	-.06	-.05	-.06	.08	-.11	1.54	.51	2	2
8 School age								.08	-.01	-.13	.07	-.06	.16*	-.04	-.18*	1.6	.49	2	2
9 Use microphones									-.12	-.05	.03	.00	.19*	.33**	.17*	14.12	4.68	16	18
10 Educational support										.10	.09	-.12	.25**	-.25**	.35**	9.11	2.88	10	12
11 Class size											.08	.11	.01	.16*	.04	21.6	8.6	21	20
12 Others with HL at school												.16*	.03	-.05	-.04	1.22	.41	1	1
13 Others with HL in class													-.10	.16*	-.12	1.61	.49	2	2
14 Parental involvement														.13	.33**	7.84	1.63	8	8
15 Hearing loss															.03	1.70	.45	2	2
16 Several impairments																1.52	.70	1	1

\*\* $p \leq .01$ .\* $p \leq .05$ .



**Figure 2.** The modified structure equation model of participation in teaching activities. The associations between the exogenous variables and the endogenous variables.  $\chi^2 = 35.91$ ;  $df = 29$ ;  $p$ -value = .17; RMSEA = 0.038; GFI = 0.96; AGFI = 0.92; CFI = 0.98.



**Figure 3.** The modified structural equation model of social participation. The associations between the exogenous variables and the endogenous variables.  $\chi^2 = 38.15$ ;  $df = 31$ ;  $p$ -value = .17; RMSEA = 0.032; GFI = 0.96; AGFI = 0.92; CFI = 0.98.

**Table 5.** The total effects that the variables in Figure 2 have on one another (standardized beta coefficients).

	HL	Several impairment	Parental involv.	Edu. support	Use mic.	US	UT	Sex	Academic motivation	Self-confidence
Parental involvement		.32								
Educational support	-.28	.36	.19							
Use microphones	.33	.16								
Understand Students	-.00	.38	.04	.22	.18					
Understand Teachers	-.05	.33	.24	.31	.10	.54				
Academic motivation	.15	.47	.43	.20	.14	.14	.26	-.14		
Self-confidence	.12	.22	.18	.08	.22	.06	.11	.19	.41	
Participation in academic activities	.09	.35	.23	.16	.15	.34	.14	-.03	.51	.18

**Table 6.** The total effects that the variables in Figure 3 have on one another (standardized beta coefficients).

	HL	Several impair.	Parent	Edu. support	Use mic.	Other pupils with HL	UT and US	Sex	Academic skills and motivation	Self-confidence
Parental involvement		.32								
Educational support	-.27	.35	.20							
Use microphones	.33	.16								
Understand teachers and students.	-.07	.41	.27	.24						
Academic skills and motivation	.15	.47	.45	.19	.10		.26	-.17		
Self-confidence	.11	.22	.19	.08	.19		.11	.15	.41	
Social participation	-.00	.45	.05	.05	.04	-.15	.21	.07	-.01	.29

### Factors associated with social participation

Figure 3 illustrates the pathways to social participation. The SEM analysis indicates that ‘additional disabilities’ appears to be a major pathway similar to the correlation with ‘participation in teaching activities’. The total effect ( $\beta = .45$ ) explains most of the variance in social participation, as Table 6 shows. Being able to understand the overall classroom communication ( $\beta = .21$ ) is positively associated with social participation.

‘Self-confidence’ ( $\beta = .29$ ) also has a positive correlation with social participation. ‘Academic skills and motivation’ ( $\beta = -.14$ ) appears to have a negative association, as Figure 3 illustrates, but also shows a positive indirect relation; the total effect is approximately zero. Participation in teaching activities is not related to ‘social participation’ when other variables are controlled. Only the environmental factor ‘other pupils with HL at the school’ ( $\beta = -.15$ ) is associated with social participation. Parental involvement indicates a pathway, but the indirect association between ‘parents’ involvement’ and ‘social participation’ becomes insignificant. The independent variables explain approximately 32% of the variance in ‘social participation’.

### Discussion

This study explores teachers’ views on school participation of students with HL and examines the relationships among the ICF-CY factors and the students’ school participation. SEM analyses were performed to investigate the possible relationships among the factors.

#### The students’ level of participation in school

The teachers reported that the majority of the students participate academically at the same level as their average classmate. However, they participated slightly less in class discussions than in teacher-

led activities compared with the average classmate. Classroom conversation is more difficult to follow and participate in than teacher-led activities; indeed, teacher-led activities are more structured and involve fewer communicators, which can explain the differences. Although, the results are based on the teachers' subjective observations, other studies have drawn similar conclusions. Borders, Barnett and Bauer (2010) observed classroom participation of five children with mild-to-moderate HL within inclusive classroom settings compared with peers with typical hearing. Similar responses to practice and prompt opportunities were observed, indicating that the students and their peers had similar participation rates. However, the students with HL required higher levels of prompting and were less accurate when following class-wide verbal prompts.

The teachers considered their students to be slightly more attentive towards teaching activities and slightly less active during teaching activities compared with their average classmate. Individuals with HL often speech read when listening, which may make them appear more attentive than listeners without HL. The distinction between active and passive participation can be defined in terms of either taking an active part in a game or simply observing it, respectively. Participating actively while attempting to perceive communication is challenging, this explains why the students are, to a certain extent, passive participants.

The majority of the teachers considered the students to be socially included to a positive degree. Children with HL are found to be accepted by peers and to have friendships that are equal to those of hearing children (Wauters and Knoors 2008). However, qualitative studies report that children with HL experience difficulties with social interactions and feelings of loneliness (Bat-Chava and Deignan 2001; Preisler and Tvingstedt 2005; Punch and Hyde 2011). It is possible that the teachers here are not fully aware of the level of inclusion that the students experience from their peers, which leads the teachers to believe that the students are more included than they actually are. On the other hand, Norwegian teachers are responsible for including all students socially, and therefore should be aware of the social life in the class.

### *Participation in teaching activities*

The results indicate that there is a multifaceted interaction between the ICF-CY factors and the students' participation in teaching activities. Personal factors, such as the students' academic skills and motivation, appeared to be strongly associated with participation in teaching activities, a finding that is consistent with other studies (Luckner and Muir 2001). The students' self-confidence is further related to participation in teaching activities. Psychological characteristics are found to explain most of the variance in school participation by students with disabilities (Almqvist and Granlund 2005). However, the factors of activity, environment and type of impairments and degree of HL are connected to the students' psychological characteristics, and indirectly or directly associated with participation in the teaching activities.

This study supports findings that students who are able to understand all classroom communication perform better in school compared with students who do not understand. (Antia, Sabers, and Stinson 2007). If students lack the ability to perceive the total classroom communication, they cannot freely choose whether to become involved in teaching activities, and this may negatively affect their academic skills and motivation, as the results show.

In particular, the use of microphones was positively associated with understanding classmates but not with understanding teachers. Distance to the classmates may make it harder to understand classmates without microphones. Further, the classmates may sit behind the students with HL. Another explanation may be that the teachers are not fully aware of how the students with HL understand them. Rekkedal (2014) revealed that teachers' ratings of how often students with HL understood them significantly differed from the students' ratings. A higher amount of teachers reported that the students understood them more often compared to what the students reported. The students in primary school also reported understanding their teachers and classmates significantly more often than the secondary students did; however, the teachers' ratings did not reflect this difference.

(Rekkedal 2014). The teachers may overestimate the students' understanding of them. This may explain the weak association between microphone use and the understanding of classroom communication, even though both factors affected 'academic skills and motivation' and 'self-confidence'.

Microphone use may create an accessible learning environment and predictable communication situations, which in turn are important for students' academic skills and motivation. Microphone use can further demonstrate teachers' and classmates' attitudes towards the inclusion of students with HL, which may contribute to a supportive learning environment. Teachers without knowledge about hearing impairment and the amplification system do not handle the technology, and rarely meet the students' needs (Iantaffi, Jarvis, and Sinka 2003). Consequently, an inclusive school depends on the schools and the teachers' attitudes and willingness to make necessary adaptations. Teachers who are compassionate tend to develop their students' motivation and belief that they are successful in school compared with teachers who are less concerned (Hansen and Simonsen 2001). This is in line with the findings here.

Another important finding was the central role of parents, which is in line with other studies (Hill and Taylor 2004). Highly involved parents were positively associated with students' participation in teaching activities. Such parents may have higher demands towards their children and the teachers. They can be more encouraging; consequently, their children perform better in school and need less educational support.

This finding was confirmed by the improved 'academic skills and motivation' among those children. Interestingly, there was a positive association between the parents' involvement and the students' understanding of the teachers. Teachers are found to use microphones more regularly if parents are highly involved in their child's schooling compared to parents of lower involvement (Rekkedal 2013). This may explain the result. According to Hill and Taylor (2004), there are two major mechanisms, social capital and social control through which parental involvement in school promotes student achievement. Parents who establish relationships with their child's school provide information and insight on school policies and practices. And teachers obtain information about what the parents' expect from their children and from the teachers. This understanding increases the teachers' and parents' skills and information (i.e. social capital). A family and school consensus on appropriate behaviour that is communicated to children at home and at school represents social control.

The third environmental factor, 'educational support' also related to participation in teaching activities is consistent with other studies (Antia, Reed, and Shaw 2011). Children who need a high level of assistance during activities participate less in school activities. In addition, receiving educational support is negatively associated with 'academic motivation' and understanding teachers and classmates.

The presence of additional disabilities and HL were essential pathways and were associated with 'academic skills and motivation' and 'self-confidence'. Previous research shows that students who have several disabilities perform at a lower level compared with students with only HL (Brunnberg, Bostrom, and Berglund 2008). Remarkably, the teachers less often implemented microphones in common classroom activities when students had additional disabilities. This seem to exacerbate the students' challenges in understanding classroom communication, and further be related to low academic skills and motivation and low participation rate.

This confirms that the schools practice inclusive education different as Jenssen describes (2011), and this may depends on the students' type of disabilities.

The students with severe HL seemed to experience a more supportive environment compared with the students with mild HL, as illustrated by the negative association between mild HL and microphone use. The teachers may not be aware of those students' needs for an improved listening environment, and this lack of awareness may explain why students with mild HL are considered to have lower 'academic skills and motivation' than the students with severe HL. Also the students with mild HL themselves report significantly lower motivation towards schools compared to the students with severe HL (Rekkedal 2015). Few teachers of students with mild HL were regularly followed

up by a hearing therapist. Consequently, they may not be fully aware of those students' needs, which may explain the results.

Similar difference between students with mild and severe HL are found in another Norwegian study in which students with mild HL tended to have poorer outcomes in all academic subjects compared with students with severe HL (Hendar 2012). As the present results show, this discrepancy may be caused by the limited support offered to the students with mild HL over time. Antia et al. (2011) stated that the level of support available in schools is a more pragmatic and holistic factor than the students' level of HL. However, the study shows that the interaction among factors is complex and requires further examination to be confirmed.

### **Social participation**

Compared with participation in teaching activities, fewer factors were related to the students' social participation. Social activities are informal and normally initiated by the children themselves, and seldom adapted to the students' needs.

Based on the teachers' reports, the presence of additional disabilities explained most of the variance in social participation. The students with additional disabilities received instruction in the classroom less frequently and had few interactions with peers, which may cause difficulties in establishing positive relationships. Opportunities for social interaction are necessary for developing friendships, which can be promoted through participation in formal and informal activities (Solish, Perry, and Minnes 2010). Although the degree of HL indicated a pathway, it was not related to social participation.

The personal factor 'self-confidence' appeared positively related to social participation, whereas 'academic skills and motivation' appeared unrelated. It is asserted that students who participate actively in educational process develop positive social relationships (King et al. 2006; Dammeyer 2010). Nonetheless, it is also reported that participation in one life situation does not indicate involvement in other life situations (Raghavendra et al. 2007), and the present results seem to confirm this. Participation in teaching activities was unrelated to social participation, which may explain why 'academic skills and motivation' did not associate with social participation. Wauters and Knoors (2008) reported similar findings, but stressed the importance of communicative performance. Although there was an association between understanding communication and social participation, this relationship was weaker than the association between understanding communication and participation in teaching activities. The reason may be that teaching activities are often based on communication with several participants, whereas social participation with peers includes play activities and small-group conversation, which may depend less on the degree of comprehension than general classroom communication does. Supportive environmental factors were therefore less related to social participation compared to participation in teaching activities.

Parental involvement had no significant association with social participation. This is in agreement with findings in other studies (Nordahl and Skilbrei 2002). Parental involvement have no influence on students' ratings of the class atmosphere or peer relationships. It is reasonable to assume that parents have less influence on children's relationships and activities. The activities are unstructured and commonly initiated by children, different from the structured activities led by teachers, with whom parents can confer and collaborate. The use of microphones did not have significant association with social participation either, possibly because participation in teaching activities did not relate to social participation.

Only the environmental factor 'other students with HL at the school' was significantly related to social participation. Brunberg (2003) describes the relationships among students with HL and students with typical hearing as vertical relationships and describes the relationships among students with HL as horizontal relationships. Students feel less emotionally secure with hearing peers than with peers who have HL (Stinson, Whitmire, and Kluwin 1996). Children without disabilities have a more dominant role in relationships than children with disabilities (Skär and Tamm 2000), or have



a supportive role. Hence, the students in this study may prefer to be grouped with children similar to themselves when such a milieu exists. They may use sign language; however, the majority of the students did not to use sign language in the teaching.

The explanation rate for the examined factors was lower for social participation than for participation in teaching activities. Other personal characteristics that are considered important, including an outgoing and friendly nature, a positive attitude optimism and resilience (Oberle, Kimberly, and Kimberly 2010), could perhaps have explained more of the variance in the results.

## Conclusions

The majority of the teachers considered the students with HL to participate in teaching activities and to be socially included to a positive degree. Utilizing the ICF-CY as a model to explore pathways to participation in school activities produced valuable results and shows that a complex variety of factors influence school participation. Although the findings support the claim that psychological factors play a vital role (Geyh et al. 2011), this is related to the environmental factors. The present findings suggest that students with mild HL experience more difficulties than students with severe HL because they inhabit a less supportive educational milieu. Although the frequent use of microphones had a low correlation with participation, it appears to have positive relationship with understanding classmates, self-confidence, and academic skills and motivation. The students with several disabilities and the students whose parents are less involved in their education also are at risk, which is consistent with other studies. This study also shows that inclusive teaching is practised differently depending on the types of disabilities and the degree of HL.

This study contributes to an improved understanding of how the factors of the ICF-CY are related to students' participation in academic activities and their social participation.

## Limitations

The examination of causalities in the social and behavioural sciences is problematic (Blunch 2008). Such investigations must be based on theory and evidence, and longitudinal data and replications of investigations are required to increase the reliability of posited causalities. Many of the findings in this study appear to agree with the predicted model, but further research is needed.

The findings may only be relevant to Nordic school systems because of their educational policies and their particular views of children. Nordic countries are obliged to raise democratic citizens, and students' influence on the central work of schools is stressed in academic-steering documents. It is also compulsory and common in Nordic countries to have student councils, which are uncommon elsewhere (Mikkelsen 2004). Additionally, Nordic students report a stronger sense of belonging at school compared with the OECD average (Arnesen and Lundahl 2006).

Because of the low student participation rate, there are some limitations to our findings. No objective measurements were performed, and no control group of participants with typical hearing was included to provide a comparison of participation rates. Furthermore, the comparison of the students' participation with that of their classmates only represents the teachers' subjective views, although there seems to be similar views by the students themselves regarding personal factors.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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