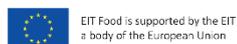




Virtual reality in teaching: The tomato project

Sýndarveruleiki í kennslu: Tómataverkefnið



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Ágríp á íslensku:	<p>Börn eru yfirleitt áhugasöm um nýja tækni og opin fyrir nýrri þekkingu, svo framarlega sem hún er sett fram á áhugaverðan hátt. Framkvæmd var íhlutunarrannsókn sem hafði það að markmiði að meta hvort sýndarveruleikamiðað fræðsluefni hafi meiri áhrif á nám og viðhorf barna á aldrinum 12-13 ára en hefðbundnari leiðir til að kynna efnið. Íhlutunin fól í sér fyrirlögn á nýju kennsluefni í sex grunnskólum þar sem lögð var áhersla á heilsusamlegt matarræði til að stuðla að eigin heilbrigði sem og jarðarinnar. Kennsluefnið innihélt glærupakka, sýndarveruleikamyndband og verklegar æfingar. Íhlutunin gekk undir vinnuheitinu “Tómataverkefnið” þar sem þemað var tómatar. Lögð var áhersla á sjálfbærni, uppruna matvæla, matvælatækni, matvælaframleiðslu, matarsóun o.fl. í tengslum við tómata. Spurningalisti var lagður fyrir börnin, bæði fyrir og eftir íhlutun, til að mæla áhrif kennsluefnisins á nám og viðtöl tekin við kennara að íhlutun lokinni til að meta gagnsemi kennsluefnisins í kennslu.</p> <p>Niðurstöður íhlutunarinnar bentu til þess að notkun sýndarveruleika í kennslu geti aukið áhuga á matvælum og stuðlað að jákvæðum breytingum á viðhorfi barna til hollara og heilbrigðara matarræðis. Á heildina litið var ánægja með kennsluefnið meðal kennara, þeir kennarar sem höfðu notað sýndarveruleikagleraugun voru áhugasamastir. Íhlutunin sýndi einnig fram á að hægt er að samþætta notkun sýndarveruleika við kennslu á öðru formi. Jákvæð námsupplifun og aukinn áhugi á hollu mataræði þ.m.t. á að borða tómata, kom fram í öllum tilvikum, óháð gerð kennsluefnis. Einnig voru kennarar ánægðir með kennsluefni sem innihélt svo fjölbreytt úrval hugtaka sem hægt var að sameina í þemanu og hvernig hægt væri að samþætta fræðilegt og hagnýtt nám. Reynsla kennara var sú að hægt væri að fara yfir mikið efni á tiltölulega stuttum tíma.</p>		
Lykilorð á íslensku:	Sýndarveruleiki, matur, námsefni, sjálfbærni, skynfæri, skemmtiment		

<p><i>Summary in English:</i></p>	<p>Children are generally excited about new technology and open to consume knowledge if it is made interesting to them. An intervention study was performed which goal was to assess whether virtual reality-based educational material has a greater impact on children's learning and attitudes than more traditional ways of presenting the material. The intervention involved the introduction of new teaching materials in six primary schools where the emphasis was on healthy eating for one's own well-being and as well as of the planet. The teaching material included a slide pack, a virtual reality video and practical exercises. The intervention went under the working title "The Tomato Project" as the theme was tomatoes. Emphasis was placed on sustainability, food origin, food technology, food production, food waste, etc. in relation to tomatoes. The children filled in a questionnaire before and after the intervention to measure the effect of the teaching material on learning and interviews were conducted with teachers to evaluate the usefulness of the teaching material in teaching.</p> <p>The results of the intervention indicated that the use of virtual reality in education can increase interest in food and contribute to changes in children's attitudes towards healthier and healthier diets. Overall, there was satisfaction with the teaching material among teachers, those teachers who had used the virtual reality glasses were the most interested. The intervention also demonstrated that the use of virtual reality can be integrated with teaching in other forms. Positive learning experiences and increased interest in healthy eating, including eating tomatoes, were observed in all cases, regardless of the type of teaching material. Teachers were also pleased with the teaching material that contained such a wide range of concepts that could be combined in the theme and how theoretical and practical learning could be integrated. The teachers' experience was that it was possible to cover a lot of material in a relatively short time.</p>
<p><i>English keywords:</i></p>	<p><i>Virtual reality, food, educational material, sustainability, senses, infotainment</i></p>

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1 Introduction

The origin of food is unclear to many children today as they are used to the idea that food comes in packaging from a store. Consumption of food directly from wild nature or farms is much less common than before. Knowledge on food i.e. the role of nutrients, where food comes from and how it is made, is generally lacking among children. Knowledge and a subjective interest in food is crucial for developing healthy and sustainable eating habits, reducing the risk of obesity and lifestyle originated diseases (Baharti et al, 2021). As food consumption patterns in early age can be predictive for health behaviour in adult years (Olafsdottir A.S., 2016) the younger generations' awareness and sufficient knowledge of food origin, production and consumption are fundamental.

Children are generally excited about new technology and open to learning new things if it is made interesting to them. Research also confirms that practical, interactive exercises have a high potential in raising curiosity, filling knowledge gaps, and improving children's critical thinking. Teachers play a crucial role in impacting the lives of children. In today's fast changing world, there is a need to support teachers in applying holistic and integrated educational approaches using methodologies that help address the complexity of the issues related to health and sustainability (Albareda-Tiana et al, 2018).

Virtual reality (VR) is a relatively new tool that teachers can use as a part of their toolbox in delivering education to children. It can provide their students with more realistic view on the educational topic as it gives them an opportunity to be at the place where food is made without travelling. Using virtual reality (VR), might spark more interest among school children in the educational material than traditional means of teaching. It can support teachers, who want to reach students at home (lockdown) or to reduce cost related to education as the VR technology allows for virtual visits to food production sites. This may also make education approaches more flexible and resilient in the long term.

The aim of the intervention research was to use VR as a factor of knowledge and attitude change towards more sustainable and healthier diet and career vocation in school children. To evaluate the effectiveness of VR the following research question was framed: *Will VR based educational material have more impact on children's learning and engagement than traditional means of introducing the topic?* These include awareness, engagement, and interest in sustainable use of resources, how food is made, food technology and healthy eating. The target population was a cohort of 12 -13-year-old children. At this age, the children have been introduced to the concepts of healthy eating, sustainability, and food resources to some extent but these concepts are for many difficult to understand.

The aim of the educational material developed for the intervention was to increase food knowledge and a healthy relationship with food. The children were educated about two aspects of health: their own and the health of the planet. Eating healthy and keeping a healthy weight gives them energy; choosing sustainable food has a big impact on the health of their planet in the future. The knowledge they obtain about healthy eating and sustainability empowers them to take informed decisions and shape their own future. Knowing where their food comes from also includes to be aware that food resources are not infinite. The educational material was aimed also to spark curiosity about food technology and create an awareness in children that innovation and new ideas can be both: healthy and sustainable. Within the study, focus was put on one type of food to test the study concept: tomatoes.

This report gives overview of the work done within the *Tomato project* (IS: *Tómataverkefnið*) which was part of the EIT Food supported project Redvile. The project was made in collaboration between Mátis, University of Iceland and the film producer Árfilm. It consisted of design and creation of teaching material, school engagement and intervention, collection and analysing of data. For more detailed information about the implementation and results see MSc thesis of Svava Sigríður Svavarsdóttir, [Sýndarveruleiki í kennslu](#).

2 Material creation

Syllabus and teaching material on the beforementioned topic with the theme tomato was designed and created (**Figure 1**), see syllabus in Annex and online [here](#).

<p>Matvæli, sjálfbærni og heilsusamlegt mataræði</p> <p>Kennsluáætlun</p> <p>Bekkur: 6.bekkur - 8.bekkur</p> <p>Námsgrein/ár: Heimilisfræði, náttúrufræði og samfélagsfræði</p> <p>Tími: Gert er ráð fyrir að verkefnið teygji sig yfir 3 vikna tímabil og því séu tekin þrjú skipti í efnid. Fyrir flesta skóla myndi slíkt fela í sér 4-6 kennslustundir, en það fer eftir tíma sem gefinn er í verkegla vinnu.</p> <p>Markmið: Niðurlid er uppruni matvæla mörsum börnum djúps þar sem þau eru vön þeirri hugmynd að matur komi í umbúðum úr verslun. Neysla matar beint frá villtri náttúru eða bæjum er mun sjaldgæfari en áður. Almenn skorir börn þekkingu á matvællum, þ.e. hlutverk næringarefna, hvaðan matur kemur og hvernig hann er framleiddur og framreiddur. Slík þekking er ein af grunnstöðum þess að þróa heilbrigðar matarvenjur.</p> <ul style="list-style-type: none"> Nemendur læri um mikilvægi nærumhverfisneyslu Nemendur læri um sjálfbærni Nemendur læri um tómat og að matreiða úr þeim <p>Sjálfbærni, heilbrigði og velferð eru megal grunnþátta menntunnar.</p> <p>Hæfnivæðing: Við lok 7.bekkjargættur nemandi:</p> <ul style="list-style-type: none"> matreitt einfaldar og hollar máltíðir og nýtt hræfnið sem best, umnið sjálfstætt eftir uppskriftum og notað til þess algengustu mæli- og eldhúshöld tengt viðfangsefni heimilisfræðinnar við jafnrétti og sjálfbærni og áttáð sig á uppruna helstu matvæla skilið og rætt mismunandi umbóðarmerkingar, metið útlit og gæði matvæla og útskýrt hvernig á að geyma þau rætt mikilvægi samvinnu í samstilltum aðgerðum sem varða eigið umhverfi 	<ul style="list-style-type: none"> tekid þátt í að skoða, skilgreina og bæta eigið umhverfi og náttúru rætt um hvernig ræktanlegt land er notað og ýmsar hliðar landnotkunar og verndunar gróður gert grein fyrir notkun manna á auðlindum lýst hvernig rafmagn verður til, eiginleikum segla og notkun þeirra gert grein fyrir næringargildi dillrar fæðu og hvers konar fæða er framleidd á Íslandi gert sér grein fyrir nýtingu og vernd auðlinda og umhverfis, hvernig hver einstaklingur getur lagt sitt af mörkum til verndar. <p>Fræðslan:</p> <ul style="list-style-type: none"> mun miða að því að auka matvælaþekkingu og heilbriggt samband við mat mun fræða börn um tvo þætti heilsu: þeirra eigin og heilsu plánetunnar. mun auka vitund barnanna um mikilvægi þess að borða hollan mat sem nærir þau, gefur þeim orku og hjálpar þeim að viðhalda æskilegri byngd miðar að því að vilja velja sjálfbæra fæðu sem hefur mikil áhrif á heilsu plánetunnar þeirra í framtíðinni sem börnin fá um heilbriggt mataræði og sjálfbærni gerir þeim kleift að taka upplýstar ákvarðanir og móta sína eigin framtíð. Að vita hvaðan maturinn kemur og mikilvægi þess að vera meðvitað um að auðlindir eru ekki óendanlegar. <p>Viðfangsefni/meginhugsn</p> <p>Auðlindir Sjálfbærni Nærumhverfisneysla Ræktun</p> <p>Námsefni og gögn:</p> <p>Glærupakkari:</p> <ul style="list-style-type: none"> Auðlindir, ræktun, sjálfbærni og nærumhverfisneysla Tómatar <p>Gögn fyrir verkegla æfingar koma fram í glærupökkum</p> <p>VR myndband:</p> <ul style="list-style-type: none"> Tómatar: auðlindir, hollusta, ræktun, sjálfbærni, nýsköpun, nærumhverfisneysla VR þaggaþeraugu 	<p>Kennsluáferðir og lýsing á þeim:</p> <p>Útlisunarkennsla:</p> <ul style="list-style-type: none"> Fyrirlestrar Sýnkennsla Sýningar Myndmálar Hlustunarefni <p>Verkegla æfingar</p> <p>Kennslustund 1</p> <p>Kennari kynir verkefnið</p> <p>Glærukynning og umræður um hugtök</p> <p>Verkegla æfing: smakka mismunandi tómatu</p> <p>Gögn fyrir verkegla æfingu: Mismunandi tegundir og litir af tómtómum. Innlendir sem útlendir, mikill munur getur verið á bragði og öðrum skynupplifunum. Horfa – snerta – þefa – hlusta – smakka.</p> <p>Kennslustund 2</p> <p>Glærukynning um tómatu og umræður</p> <p>Sýna tómatamyndband</p> <p>Verkegla æfing: Sá tómataræfjum</p> <p>Gögn fyrir verkegla æfingu: Litlir blómappotar, mold, tómatar.</p> <p>Kennslustund 3</p> <p>Umræður</p> <p>Verkegla æfing ef vill t.d. tómatasúpa í Gott og gagnlegt, einföld bruschetta eða eitthvað matarkyns með tómtómum.</p>
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Figure 1: Food, sustainability and healthy eating syllabus showing tasks, tools and role of teacher (screenshot).

The study material consisted of VR video, Power point slides and description of practical exercises (tasting of different tomato varieties, planting tomato seeds and recipe/meal preparation (optional)). In the video (VR and 2D) the students learned about the plant, technology related to the production of the food (tomato), health aspect/nutrition of the food (tomato), about sustainability and the importance of local consumption. The video is 7 minutes, see video online via this [link here](#) (Figure 2). The video was created from video clips made within the EIT Food projects *Future Kitchen* ([VR video of an Icelandic Tomato Farm](#)) and *WeValue food* as well as clips owned by Matis and the filmmaking company Árfilms. The Power point slides were designed to cover the same information as in the video (Figure 3), see online slides via [this link about resources, sustainability and local consumption](#) and [this link about tomatoes](#).



Figure 2: Screenshots from VR video, demonstrating local food and growing of tomatoes.



Figure 3: PPT presentation about tomatoes (based on the info of the virtual world) that teachers could use PPT (screenshot).

3 Intervention

Following approval from ethical committee in August 2021, six elementary schools in the Reykjavík capital area were approached. All schools agreed on participation. The six participating schools were randomly divided into three groups, two schools in each group (for control), using three different types of intervention.

The intervention was constructed as to be a real-life educational setting, allowing schools to implement the material in practise. The educational material was structured in such a way that it could be used across disciplines. It was up to each of the participating schools to decide in which subject the material would be used in, i.e. home economics, science or art.

Presentation of the project was given to the teachers individually, before handing out the study material to explain the protocol. The message given to the teachers was that the project involved testing and comparison of education methods on sustainable uses of resources, food technology, food processing and healthy eating. The teachers did not receive any information on what kind of educational methods were being compared, that VR as such was being tested, nor which other schools were involved. To compare the effectiveness of VR based educational material compared to traditional means of learning, study material was presented to schools/teachers in three different ways. All the participating schools/teachers were provided with syllabus, two sets of Power point slides and questionnaires for their students. In addition, two schools received link to the video and were instructed to display the video from a computer screen for the whole class (2D screen) and two schools received the video link as well but were instructed to give VR glasses to each student to watch the video (**Figure 4**). All the teachers were instructed to give the material during three sessions over at least three weeks.



Figure 4. Intervention set up. Two schools were taught only from presentations using slides (1), two schools were taught from slides and watched a video on a screen (2) and two schools were taught from slides and watched a video with 3D glasses (3).

The learning outcomes were evaluated based on outcome of questionnaires answered by the students pre and post the intervention (see questionnaire in Annex). The questionnaires consisted of 30 questions. Of those, the first 25 questions were on a five-point scale (never /very unlikely = 1 point, rarely/less often than weekly /rather unlikely = 2 points, sometimes /maybe = 3 points, often /rather likely = 4 points, and always /very likely = 5 points). Thus, each question could score a minimum of 5 points and a maximum of 25 points. In questions 26 (14 options), 27 (12 options) and 28 (6 options) one or more options could be chosen. Questions 29 and 30 were open questions and optional. For statistical analysis, the first 25 questions were grouped according to themes (Table 1): *Food waste; Food origin and sustainability; Food involvement; Interest in food; Interest in food production; Food labelling; Healthy eating and Tomato availability.*

Table 1. Categories questions were grouped within (see list of questions/questionnaire in Annex).

Category	Questions
Interest in food	11,17,18,19,22
Food waste	14,15,16
Food origin and sustainability	1,2,7,21
Food labelling	5,6,7
Healthy eating	5,12,13,25
Food involvement	1,4,8,9,10
Interest in food production	1,3,20,22
Tomato availability	23,24

Quantitative statistical analysis methods were used for processing of the data and evaluate change (post minus pre) by type of intervention (VR, video, slides) per questions and themes (Anova, post hoc, chi-square, Cramer’s V). The satisfaction (usability, ease of use, potential of re-use) of the educational material was evaluated based on responses from teachers interviewed on-line via Microsoft Teams.

The first schools began the pilot teaching late September and the last ones completed early November. The questionnaires were collected from all schools and the participating teachers interviewed late November. Three to four weeks passed between the first and second questionnaires and at least one week passed between lessons two and three. A total of 236 students were listed for participation by the schools, in the end 142 students completed both pre and post questionnaires, 82 girls and 60 boys. Analysis of results was based on responses from students who answered questionnaires both pre and post intervention. Of those, 48 students watched the VR video, 48 watched the video displayed on screen (2D) and 46 students got information only via slides. Majority of the students were in the cohort of 12–13-year-old. Teachers from five out of six schools were interviewed.

4 Results

Comparison between responses from students pre and post intervention showed positive impact of using VR glasses on interest and behaviour of the children compared to watching the video on screen or having the information only on slides. Table 2 shows a comparison of descriptive statistics from the first and second questionnaires (post-pre) for each category, divided by teaching method.

Table 2. Number of students answering questions (N), mean score (Mean) and standard deviation (SD) from the pre and post questionnaires for each theme (Category) and teaching method. Scores on five-point scale (never /very unlikely = 1 point, rarely/less often than weekly /rather unlikely = 2 points, sometimes /maybe = 3 points, often /rather likely = 4 points, and always /very likely = 5 points). Minimum for each question was 5 points and maximum 25 points.

Category	Teaching method	Pre questionnaire			Post questionnaire		
		N	Mean	SD	N	Mean	SD
Interest in food	VR	46	13,50	3,26	47	14,49	3,31
	Video	46	13,61	3,00	47	13,45	3,30
	Slides	45	15,40	2,81	45	14,60	3,06
Food waste	VR	46	8,57	2,06	48	9,08	1,69
	Video	43	9,70	2,44	46	9,59	2,64
	Slides	45	9,40	2,37	45	9,18	2,22
Food origin and sustainability	VR	47	8,94	2,71	47	9,53	2,89
	Video	45	9,18	3,43	45	9,73	3,65
	Slides	45	8,69	2,91	45	9,16	2,65
Food labelling	VR	47	8,40	2,32	48	8,52	2,76
	Video	46	9,00	2,68	47	9,23	2,55
	Slides	45	9,56	2,17	45	9,58	2,34
Healthy eating	VR	46	13,65	2,70	47	13,77	2,64
	Video	45	13,93	2,61	46	13,63	2,66
	Slides	45	13,76	2,65	46	13,63	2,89
Food involvement	VR	47	15,19	3,54	46	15,63	3,19
	Video	44	18,82	3,27	47	15,62	3,13
	Slides	46	15,41	3,15	46	15,28	3,48
Interest in food production	VR	46	8,67	2,30	46	9,22	2,48
	Video	46	9,04	2,29	46	9,24	2,69
	Slides	45	8,87	2,82	46	8,80	2,61
Tomato availability	VR	48	6,27	1,87	47	6,36	1,72
	Video	45	6,47	1,91	46	6,54	1,52
	Slides	46	6,35	1,83	46	6,59	1,82

Table 3. Difference (Δ) in scores between post- and pre-questionnaires for each theme and teaching method. Results from a one-way Anova analysis. Significance increase (+ value) or reduction (-value) in Δ indicated by P value marked in bold. Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

Category	VR (Δ)	Video (Δ)	Slides (Δ)	P value
Interest in food	1,11	-0,04	-0,77	0,002*
Food waste	0,57	-0,10	-0,25	0,103
Food origin and sustainability	0,70	0,55	0,43	0,792
Food labelling	0,23	0,29	0,11	0,880
Healthy eating	0,16	-0,23	-0,16	0,541
Food involvement	0,62	-0,21	-0,13	0,208
Interest in food production	0,59	0,14	-0,07	0,229
Tomato availability	0,15	0,05	0,24	0,826

Post intervention, students receiving VR education had increased interest in food ($p=0,002$) compared to students receiving traditional education (only slides) (

Table 3). Difference between those who had watched the video via VR glasses versus video was however not significant ($p = 0,078$) (see Annex). Although no significant results were shown on more categories, there were significant results on individual questions within the following categories: food origin and sustainability, food involvement, and interest in food production (see Table 4). All groups scored higher on food origin and sustainability post intervention.

Table 4. Sub-questions where significant difference was found between groups. Results from one-way Anova and Tukey Post-Hoc test after subtracting the scores from the post- questionnaire from the pre- questionnaire. Significance marked in bold. Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Category	One-way Anova		Tukey Post hoc	
	Sub-question	P-value	Groups	P value
Food origin and sustainability	<i>How often do you think about where the food you eat comes from?</i>	0,030*	VR and slides	0,022*
Food involvement	<i>How often do you help your parents/guardians shop for food?</i>	0,035*	VR and slides	0,026*
Interest in food production	<i>How often do you visit farms or other places that produce food?</i>	0,049*	VR and video	0,059
			VR and slides	0,060

Overall, based on the outcome of the interviews with the teachers, they found this to be a very entertaining project, the children were positive, and the teachers were very happy to have been able to participate. However, most of the teachers felt they might have been able to do the project even better if they have been given a more flexible time frame and more time to prepare for the project. In many of the schools, the agenda for the semester was already set, which limited somewhat what could be done within each school. All teachers foresee to use further the teaching material they were provided within up-coming semesters, even with more integration across school subjects.

Type of teaching material schools were provided with, influenced teachers' evaluation of its usefulness/value. While teacher(s) receiving only slides, found their students less interested in the topics taught, teacher(s) receiving slides and video found the teaching material overall useful and teacher(s) receiving slides and 2D video or VR glasses were very satisfied with the teaching material. They said that children were very interested in observing and tasting the tomatoes, - and told their peers about the project. To have food production and food technology as a part of such visual or hands-on teaching material, could really help children understand where the food comes from and how it is

made, as many of them seem to lack both knowledge and understanding regarding these fundamental issues.

All teachers were convinced the students were generally positively influenced by the project and that after the project the students were more knowledgeable about the topics. Food technology and food production was differently viewed by students in different schools, both learnings and potential future carriers within these fields. Differences are noticeable regarding type of study material. Students in school(s) receiving only slides were not very keen on working within these fields, while more interest was expressed among students who were taught using slides and 2D video or VR glasses, both regarding interest and potential future carriers. Positive learnings, experience and increased interest in wholesome diets and interest in eating tomatoes was expressed in all cases, regardless of teaching material.

The teachers were satisfied with that the teaching material included such wide range of terminology that could be combined in the topic, and how theoretical and practical could be integrated. This was considered as new. The teacher(s) experience was that a lot of material could be covered in relatively short time. Some of the terminology used, was new to the students and some needed thorough explanations, but this varied between schools. One teacher mentioned that when students answered the post questionnaire, it was clear they knew much more than at the beginning of the project. The terminology sustainability was overall similarly perceived by the teachers. While teachers usually considered that the children understood the terminology sustainability in a similar manner as they did, they noticed some children struggled with the definition. This is clearly an important subject, and this type of learning can help bringing the message forward, even towards influencing the student's microenvironment.

5 Conclusion

From both students' questionnaires and interviews with teachers it was found that the VR based educational material had more positive impact on students' learnings, interest, and engagement than traditional way of presenting the study material. As the goal was to introduce and educate about sustainable use of resources for healthy food production, this approach may influence children's attitudes and behaviour long-term towards healthier and a more sustainable lifestyle.

Overall, there was a satisfaction with the educational material among teachers, VR teachers being the most enthusiastic. The pilot demonstrated as well that VR can be used as a tool integrated with other activities in the elementary school environment.

6 Acknowledgements

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7 References

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8 Annex

Annex 1. Protocol /Syllabus

<p>Class: 6th – 8th</p>	<p>Subject / s: Home Economics, Natural Sciences and Sociology</p>
<p>Date:</p>	<p>Time:</p> <p>It is assumed that the project together with questionnaires will extend over a period of 3 weeks and need therefore three sessions. For most schools, this would involve 4-6 lessons, depending on the time given for practical work.</p>
<p>Aim: Nowadays, the origin of food is unclear to many children as they are used to the idea that food comes in packaging from a store. Consumption of food directly from wild nature or farms is much rarer than before. In general, children lack knowledge of food, ie. the role of nutrients, where food comes from and how it is produced and served. Such knowledge is one of the cornerstones of developing healthy eating habits.</p> <ul style="list-style-type: none"> • Students learn about the importance of local consumption • Students learn about sustainability • Students learn about tomatoes and how to cook from them <p>Sustainability, health and well-being are among the basic elements of education.</p> <p>Learning outcomes:</p> <p>At the end of 7th grade the student can:</p>	<p>The education</p> <ul style="list-style-type: none"> • will aim to increase food knowledge and a healthy relationship with food • will educate children about two aspects of health: their own and the health of the planet. • will increase children's awareness of the importance of eating healthy foods that nourish them, give them energy and help them maintain a desirable weight • aims to choose a sustainable diet that will have a major impact on the health of their planet in the future • that children receive about a healthy diet and sustainability enables them to make informed decisions and shape their own future. Knowing where the food comes from and the importance of being aware that resources are not infinite.

<ul style="list-style-type: none"> • cook simple and healthy meals and make the best use of the ingredients, • worked independently according to recipes and used the most common measuring and kitchen utensils for this purpose • link the subject of home economics to equality and sustainability and understand the origins of the main foods, • understand and discuss different packaging labels, evaluate the appearance and quality of food and explain how to store them • discuss the importance of co-operation in synchronized actions concerning one's own environment • take part in exploring, defining and improving one's own environment and nature • discuss how arable land is used and various aspects of land use and vegetation protection • account for human use of resources • explain the nutritional value of different foods and what kind of food is produced in Iceland. • be aware of the utilization and protection of resources and the environment, how each individual can contribute to the protection 	
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<p>Subject/main idea</p> <p>Resources</p> <p>Sustainability</p> <p>Local consumption</p> <p>Cultivation</p>	<p>Study material:</p> <ul style="list-style-type: none"> • Slide packs • Material for practical exercises is described in the slide packs
<p>Teaching methods and their description:</p> <p>Exposure lessons:</p> <ul style="list-style-type: none"> • Lectures • Demonstrations • Media • Listening material <p>Practical exercises</p> <p>Search method:</p> <ul style="list-style-type: none"> • Questionnaires 	
<p>Timeline:</p> <p>Three weeks pass between the first and second questionnaires, minimum one week between session two and session three.</p>	

Lesson /session 1

The teacher introduces the project

The first questionnaire submitted

Remember to mark the list with numbers before the children answer so that the first and second lists can be paired together (statistical processing is based on that the first and second lists can be linked without any personal information being included)

Slideshow and discussion of concepts

Practical exercise: taste different tomatoes

Materials for practical exercise: Different types and colors of tomatoes. Domestic and foreign, there can be great differences in taste and other sensory experiences.

Watch - touch - smell - listen - taste.

Lesson /session 2

Slide show about tomatoes and discussions

Show tomato video

Practical exercise: Sow tomato seeds

Materials for practical exercise: Small flower pots, soil, tomatoes.

Lesson /session 3

The second questionnaire submitted

Discussion

Practical exercise if wanted e.g. tomato soup in "Gott og gagnlegt", simple bruschetta or some kind of tomato dish.

It is very important that practical exercises in lessons 1 and 2 are the same in all schools, freer hands after students have answered the second questionnaire in lesson 3.

Annex 2. Student’s questionnaire

Participant number: _____ (teacher will give you a number)

Date: _____

Questions connected to tomato project

Here are few questions on food in general and also about tomatoes. Choose the answer that suits you best by putting a circle around it. For some questions, we want to know how often you do something. Then choose ONE answer that you feel is best for you:

“never”: this action is something you never do

“rarely”: this action is something you would do ‘the odd time’

“sometimes”: this action is something you do sometimes, more than ‘the odd time’, but not a lot

“often”: you do this action a lot but not all the time

“always”: you do this action always

There are NO WRONG ANSWERS. You just need to be honest and tell us how often you do these actions.

.....

1. How often do you grow your own food, or help someone in your house grow food? (For example, fruits and berries, vegetables, or herbs)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

2. How often do look at what country your food comes from on food labels?

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

3. How often do you visit farms, or other places involved in producing food? (For example, vegetable or dairy farms, green houses, slaughterhouses, food processing companies or factories)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

4. How often do you help your parent/guardian with the food shopping? (For example, going to a supermarket to select food, or helping select foods to buy online)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

5. How often do you look at food health information on food labels? (For example, energy (kJ/kcal), fat, sugars, fibre, protein, salt)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

6. How often do you look at 'use-by' dates on food labels?

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

7. How often do you look at other packaging information such as certification and origin marking? (This could be for organic farming or eco-labels, for example)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

8. How often do you cook or prepare food, or help your parent/guardian with cooking or preparing food? (For example, chopping or stirring foods, frying foods in a frying pan, boiling foods in a pot of boiling water)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

9. How often do you use recipes when cooking or preparing food? (For example, following a step-by-step guide to making a meal as common in recipe books and online)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

10. How often do you bake, or help your parent/guardian with baking? (For example, baking cakes, buns, cupcakes, small bread rolls, bread etc.)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

11. How often do you like to try new foods? (Including at home or eating out in restaurants or cafes)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

12. How often do you try to eat healthy? (For example, making sure you eat plenty of fruits and vegetables, avoiding sugary foods)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

13. How often do you eat with others? (For example, eating lunch with friends at school, eating breakfast or dinner with family at home)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

14. How often do you try to reduce food waste? (For example, by eating or using up food that is about to expire)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

15. How often do you dispose of your food waste in an appropriate way? (For example, using the appropriate bin, both food and food packaging)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

16. How often do you compost ((eftover food and garden waste placed in a box / barrel and will eventually become soil), or help someone in your household compost? (I.e. putting your food waste in a bin or heap outside, where natural rubbish is allowed to mix))

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

17. How often do you read about food? (E.g. social media, magazines, cookbooks)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

18. How often do you watch any food-related media? (E.g. documentaries, TV shows, videos on social media such as YouTube, TikTok, Instagram etc.)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

19. How often do you talk to others about food? (E.g. friends and family)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

20. Would you consider working on growing Icelandic vegetables (tomatoes or other) in the future?

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

21. How often do you think about where the food you consume comes from? (eg where it is produced, eg where vegetables or meat are produced)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

22. How often do you think about how the food you eat is produced? (e.g. how is ketchup made, how is yoghurt made, how flour is made or how meat is made)

Never	Rarely	Sometimes	Often	Always
<input type="radio"/>				

23. How often are tomatoes in your home?

Never	Less often than weekly	Sometimes	Often	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. How often are tomatoes available in the school canteen?

Never	Less often than weekly	Sometimes	Often	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. How often do yo eat tomatoes?

Never	Less often than weekly	Sometimes	Often	Daily or almost daily
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. How do you consume tomatoes / tomato products? (tick all that apply)

- typical tomatoes
- cocktail tomatoes / cherry tomatoes
- buff tomatoes (large tomatoes often used as slices inside burgers)
- different tomatoes (the tomatoes can be in different colors and shapes, small, large, long, narrow, crumpled, crooked ...)
- sun-dried tomatoes in oil
- sun-dried tomatoes without oil
- ketchup
- pizza sauce
- pasta sauce
- tomato soup
- tomatoes as a topping
- tomatoes alone (for example as a snack)
- tomatoes with other vegetables in salad
- other dishes with tomatoes - write the dishes in the line

27. How do you consume tomatoes / tomato products? (tick all that apply)

- | | |
|-------|---------------|
| small | large |
| hard | soft |
| cold | warm |
| red | other colours |
| sour | sweet |

28. What have you done at school related to tomatoes:

grow tomatoes

cook from tomatoes

eat tomatoes

received instruction on tomatoes

watch a video about tomatoes

else, what? _____

29. What do you know about tomatoes?

30. Do you have any role models when it comes to food? Give examples,, they may be for example related to cooking, nature conservation, food waste or anything else that you think is important and related to the questionnaire.

Thank you!

Annex 2. Interview frame for interviews with teachers

School project about sustainability and wholesome diet, RedVile

Interviews with teachers, interview frame for moderator

1. What comes first to mind when you think about the project?
2. The project aim is to evaluate the usability of the teaching material about sustainability, food technology, food production and wholesome diet. What is your opinion of it and how do you experience this teaching material compared to other teaching material you have been using?
3. Do you foresee that you would continue to use the teaching material? All or partly? Then what (in particular), or if not, then why?
4. Are there any changes you would suggest, remove, or add? (e.g., experience, approach, time frame, assistance...)
5. Has the material been used for integration across subject? If so, how (why/why not)?
6. What do you think the teaching material leaves behind for the students?
 - a) regarding sustainability and related actions?
 - b) regarding food technology and food production? as future carrier?
 - c) regarding wholesome diet and interest in eating tomatoes?
7. What do you think the students' experience was? What about interest?
 - a) regarding sustainability and related actions?
 - b) regarding food technology and food production? as future carrier?
 - c) regarding wholesome diet and interest in eating tomatoes?
8. Are the topics or the approach in some way new to the students?
9. What about use of terminology? (Did they understand it? which terminology did they not/had trouble in understanding?)
10. In this context (if not mentioned before), I would like to ask you about the terminology sustainability. What is the meaning of it you? Did the teaching material have any impact there? What about the children and their experience and understanding of the terminology?
11. Are there any individuals, national or international, that you specifically look to or consider influencers or role models regarding the topics of the teaching material, such as origin of food, sustainability, food technology, food production and wholesome diet? Do you think that the same individuals reach children and adults?
12. Anything else?

Annex 3. Results from statistical analysis

Table 5. Interest in food, comparison between groups. Results from Tukey Post-Hoc Test after subtracting the scores from the post- questionnaire from the pre- questionnaire. Significance marked in bold. Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Method		VR	Video	Slides
VR	Mean difference	—	1,16	1,88**
	p-value	—	0.078	0.002
Video	Mean difference		—	0.73
	p-value		—	0.361
Slides	Mean difference			—
	p-value			—