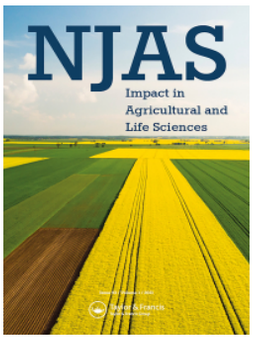

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Analysing farmers' learning for socio-ecological stewardship in Eastern Uganda: A transformative learning ecology perspective

Doreen Misanya [a], Valentina C. Tassone [a], Aad Kessler [b], Paul Kibwika [c] and Arjen E. J. Wals [a]

[a]Education and Learning Sciences, Wageningen University and Research, Wageningen, Netherlands; [b]Soil Physics and Land Management, Wageningen University and Research, Wageningen, Netherlands; [c]Extensions and Innovation Studies, Makerere University, Kampala, Uganda

ABSTRACT

This paper analyses how smallholder farmers are learning for socio-ecological stewardship in a specific case study context in Eastern Uganda. The case under analysis is a watershed management project that uses an integrated farm planning (PIP) approach to strengthen farmers' stewardship capacities within the Manafwa watershed through interactive and dialogic ways of engaging and teaching farmers. Utilizing a transformative learning ecology (TLE) perspective, this study investigated features of the PIP approach that support transformative learning for socio-ecological stewardship in a rural context. Data was collected by interviewing eighteen farmers from different villages and PIP generations and all three PIP trainers of the project, and by observing training sessions as well as sensitisation workshops. As a main result, the study yielded new insights that can help enhance PIP-like learning configurations consisting of interconnected learning tenets, dimensions and processes. This enhanced learning configurating comprises an organic learning system that facilitates farmers to change their mindsets and redefine their values, perspectives, routines, and practices towards those that encourage socio-ecological stewardship. The TLE fostered by the PIP approach represents a useful heuristic that can guide and inspire both scholars and educators engaged in processes of cultivating socio-ecological stewardship in similar contexts.

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KEYWORD Smallholder farmers; socio-ecological stewardship; transformative learning; learning ecology; PIP approach

1. Introduction

Globally, watershed ecosystems that support the health and well-being of plants, animals and humans, including farmers and other people living in

CONTACT Doreen Misanya doreen.misanya@wur.nl

rural communities, are being degraded (FAO, 2017; Mubangizi et al., 2019). This realization heightens the call to regenerate and conserve watershed ecosystems in a sustainable way. Responses to this watershed ecosystem challenge have been through technical/scientific and policy-driven interventions (Akello et al., 2017; Wang et al., 2016), but ecosystem deterioration persists and with negative impact on rural communities. Recent literature (e.g. Bennett et al., 2018; Enqvist et al., 2018) points to stewardship as a generative approach in given environmental and socio-ecological contexts in turning the tide. Stewardship calls for a shift away from techno-managerial and control-oriented approaches, towards participatory and ethical engagements rooted in shared values (Chapin et al., 2015) and moral concerns (Welchman, 2012). In this context, stewardship is explained as a form of responsible management that ensures the conservation of biodiversity, natural resources and their values in terms of use and non-use for future generations of humans and non-humans (Mathevet, Bousquet, & Raymond, 2018, p. 2).

A socio-ecological approach to stewardship focuses on enhancing ecological resilience through knowledge of ecological and social interdependencies organised within a network of interactions (Mathevet, Bousquet, Larrère, et al., 2018). This stance considers pragmatically that the resilience and overall sustainability of a system can be improved through appropriate learning processes. Learning is thus a key component of achieving sustainability outcomes (Moyer & Sinclair, 2020; Wals, 2011). It is for example recognized that smallholder farmers and rural communities need to learn their way out of dominant and resistant unsustainable routines and this in turn requires a learning process that is transformative and that triggers a rethinking of their own knowledge, ways of being and doing as well as of their relationship with the environment (Chaves & Wals, 2018; Souza et al., 2019; Wals, 2020). Nevertheless, there is a lack of knowledge of how best to create configurations that facilitate learning, transformation and the development of the know-how for stewardship (Kevany, 2007; Moyer & Sinclair, 2020; Wals, 2011).

In an attempt to understand how to facilitate learning in the context of socio-ecological stewardship, this study analyses the underlying learning configuration of the PIP approach as implemented in the Manafwa watershed in Eastern Uganda. PIP is an acronym derived from the French *Plan Integre du Paysan*, which in English means *integrated farm planning*. PIP is a non-formal learning approach that supports of smallholder farmers to deal with socio-ecological challenges, and enables those farmers as individuals and as a collective, to become stewards of their land (Kessler et al., 2020). Although this approach fosters farmers' empowerment and transformation (Kessler et al., 2020), there is limited knowledge on the characteristics of its learning configuration. By exploring this approach this study asks: "how does

transformative learning take place within the PIP approach and how does this learning help cultivate socio-ecological stewardship amongst rural farmers?" This paper thus attempts to delineate the PIP learning configuration as a potential transformative learning tool for socio-ecological stewardship in a rural context. As such, a transformative learning ecology (TLE) perspective (Wals, 2020) is used to unravel this central question in order to provide ground for reflection as well as guidance to educators, educational researchers, practitioners and communities that are searching for ways to foster learning for stewardship in similar contexts dealing with socio-ecological challenges.

1.1. Farmers' learning in Uganda

Past attempts to develop stewardship capacities through learning processes have been transmissive, technical-oriented, and inadequate in addressing socio-ecological challenges in Uganda (Waddington & White, 2014). The PIP approach to facilitating stewardship differs from such traditional training and extension approaches by applying a more reciprocal, interactive, and dialogic way of engaging farmers especially through peer-peer learning opportunities. While there have been other interactive learning-based approaches like farmer field schools in the Ugandan context (Isubikalu, 2007), these approaches tend to focus on improving agricultural production and rural livelihoods through development of knowledge and awareness and not on socio-ecological stewardship and the development of transformative capacities.

The inadequacy of knowledge in dealing with socio-ecological challenges is evident in various rural areas and watersheds of the world, for example in Uganda where 80% of smallholder farmers depend on rainfed agriculture (Okiror et al., 2011). Despite resolutions to care for the environment and adopt an ethic of stewardship (Folke et al., 2009; OHCHR, 2000), Ugandan formal agricultural education does not adequately empower farmers to handle socio-ecological challenges (MAAIF, 2018; MAFAP, 2013) in a transformative manner. Moreover, even the non-formal agricultural learning approaches (AfranaaKwapong & Nkonya, 2015; Okiror et al., 2011) in Eastern Uganda, for example, farmer-to-farmer extension through farmer field schools and community-based farmer extension agents, have largely been unsuccessful (Wellard et al., 2013) as evidenced by the deteriorating ecological potential for sustainable agriculture. The limited success is probably because extension workers/learning facilitators have limited knowledge and skills (Okoboi et al., 2013) to foster stewardship and use inappropriate instructional approaches and extension models (Friis-Hansen & Duveskog, 2012). There are also challenges of limited coverage and facilitator support, inadequate motivation, and failure to involve local stakeholders in decision making (Waddington & White, 2014).

2. A transformative learning ecology perspective

In order to explore how learning is facilitated through the PIP approach, this study applied the conceptual lenses of an ecology of learning as proposed by Wals (2020) and related tenets, referred to as a transformative learning ecology (TLE). A TLE can be explained as a networked, facilitated, and mediated learning configuration embedded in a sustainability change challenge supporting transformation and learning (Wals, 2020). Such a configuration brings multiple stakeholders on board to learn together taking advantage of their diversities to respond to a sustainability challenge while engaging into multiple forms of learning through pedagogical approaches and methods (Lotz-Sisitka et al., 2017). The learning ecology framework was first coined by George Siemens in 2005 in his study of connectivism in web-based and ICT-supported learning. Later, Wals adapted Siemen's framework to integrate a normative focus on transformation and sustainability.

While the notion of learning ecology provides conceptual support for comprehensively mapping complex learning processes (Jackson & Barnett, 2020), there is no empirical research done to map transformative learning ecologies in the context of farmers learning for socio-ecological stewardship. This study is one of a kind that attempts to apply the TLE perspective to explore the learning configuration within the PIP approach bringing together smallholder farmers from different generations to learn for socio-ecological stewardship. This study considered three TLE interconnected features - *learning dimensions*, *learning processes* and *transformative learning tenets*. See Figure 1.

Those features are briefly elucidated below:

- *Learning dimensions*. The *learning dimensions* specify the multiple dimensions that support learning, for example, knowledge building, the development of action capacities to foster change and of multiple

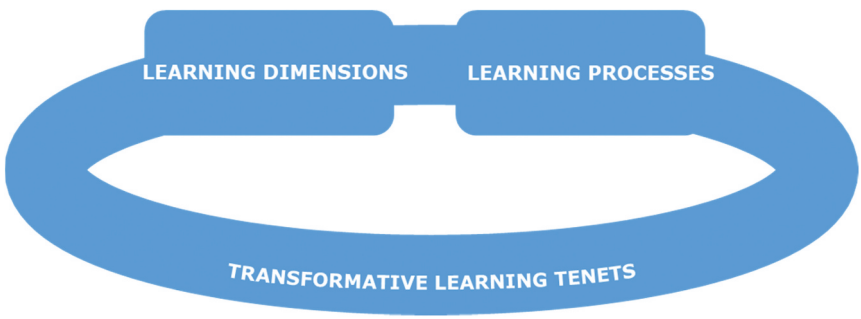

Figure 1. Transformative learning ecology features.

ways of being in relation to others and to the context within which one is situated (Wals, 2020).

- *Learning processes*. The *learning processes* are constituted by multiple aspects, for example, the predispositions of the learners influencing the learning environment and the process of learning, the pedagogical approach adopted to support *learning processes* and the mechanisms used to facilitate those processes (Wals, 2020).
- *Transformative learning tenets*. The *transformative learning* (TL) *tenets* are constituted by the principles supporting transformation of the learners throughout training practices, in connection to the *learning dimensions* and the *learning processes*. Possible *transformative learning tenets* can be, for example, related to encouraging learners to participate in dialogue, to directly engage into experiences, to reflect and question their ways of thinking, and to be exposed to alternative ways of understanding and engaging with each other within their context (Mezirow, 2009; Wals, 2020).

The study explored the PIP learning configuration by searching for signs delineating the possible *learning dimensions, learning processes* and *transformative learning tenets* as applied in the context of Manafwa watershed in Eastern Uganda.

3. Materials and methods

3.1. The study context

The study was conducted in the Manafwa watershed in Bududa district in Eastern Uganda, specifically in the three villages of Nekoshe, Elgon, and Munyende (Figure 2), where the PIP approach is implemented by the Manafwa Watershed Restoration and Stewardship (MWARES) project. The three villages were purposively sampled because they were easily accessible.

The Manafwa watershed experiences a bimodal rainfall pattern with an average annual rainfall of about 1500 mm (Bamutaze, 2015). The three villages studied border Mt. Elgon National Park and have steep slopes with fertile soils which make them attractive for agriculture. Land degradation is a major threat in the watershed, and hence the urgency that smallholder farmers, who comprise the majority of the population, to consciously change their practices through learning processes that enhances stewardship of land and natural resources in the watershed.

The PIP approach applies a bottom-up process focused on participatory and dynamic vision building, and learning of multiple generations of smallholder famers (Kessler et al., 2020). Through its visioning tool, the approach

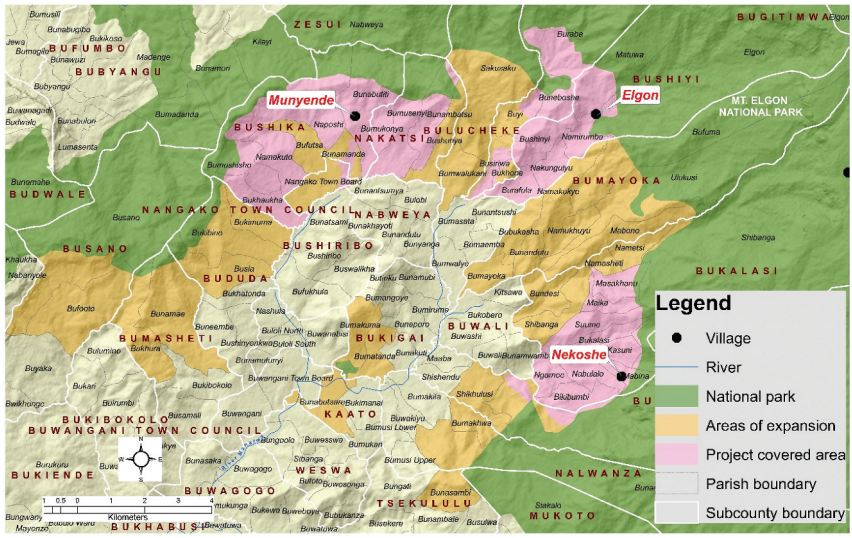

Figure 2. Map of the Manafwa Watershed showing the study area.

facilitates farmers to understand and map their current and desired farm and household situations as individuals and as a collective, and then engage in action planning to operationalize the aspirations for their desired situation. This process is guided by the principles of collaboration, empowerment and integration with the aim of facilitating farmers' learning to change their mindset and practices in the watershed (Kessler et al., 2020).

Implementing the PIP approach in the Manafwa watershed started with sensitization of the first generation[1] of farmers (G1s), also referred to as *paysan innovateurs* (G1s), trained by the project staff, known as the Junior Agronomists (JAs). G1s are identified by community leaders based on being residents, voluntarism, land ownership, approachability, visionariness and respectability in the community (Kessler et al., 2020). G1s are a special group that is exposed to more technical trainings and a close relationship with the JAs as compared to other farmer generations. On completion of their training, each G1 trains 8–10 other farmers who constitute the second-generation PIP farmers (G2s). These G2s also select and train other farmers, who constitute the third-generation PIP farmers (G3s). These three generations of trained farmers were the units of analysis in relation to how they learned for socio-ecological stewardship in the context of Manafwa Watershed. The process by which the PIP process scales out is illustrated in Figure 3 below.

[1]A is used within the PIP approach to refer to a cohort of farmers (Kessler et al., 2020).

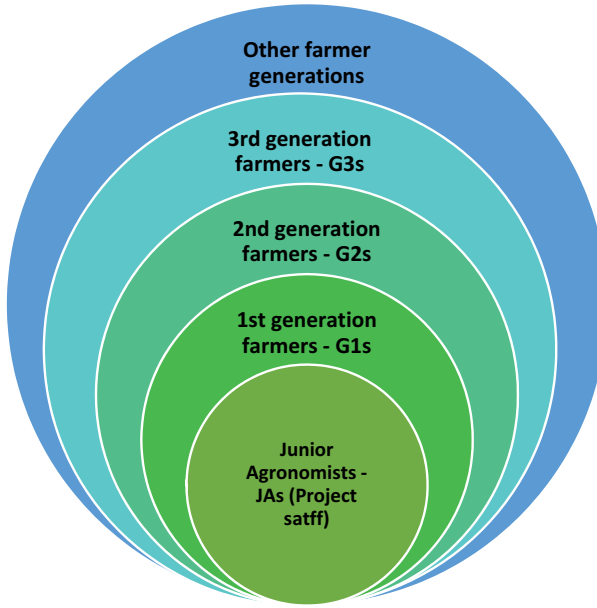

Figure 3. The farmer generations involved in the PIP learning approach.

3.2. Data collection and processing

This research employed a qualitative case study approach (Stake, 1995). Data were collected through semi-structured interviews supplemented by observations.

A total of 18 farmers (6 from each of the three farmer generations) were purposely sampled from 3 villages to participate in interviews. Two farmers from each farmer generation in each of the 3 selected villages were sampled based on having been trained, training others, their observed engagement during trainings and sensitisation workshops, and their accessibility in terms of geographical location. It was assumed that these farmers had a deeper understanding of and commitment to the PIP approach and were thus well positioned to share useful insights for this study. Based on similar criteria above, each G1 helped to identify a G2 out of those they had trained and that G2 would also identify a G3 they had trained. Additionally, all the project JAs (3 in total) were interviewed. Each interviewee endorsed an informed consent form. After interviewing 12 farmers in two villages (Nekoshe and Munyende), interviews held with the remaining 6 farmers in the 3rd village (Elgon) did not reveal any new data. Therefore, data saturation (Saunders et al., 2018) had been achieved. As such, data from 6 farmers from the 3rd village were simply repetitive albeit confirmatory.

Semi-structured interviews of the 18 farmers were conducted in Lumasaba, the local language with the aid of a local research assistant, while the JAs were interviewed in English. These interviews focused on understanding how farmers were learning through PIP, and the PIP learning features as experienced by the farmers and JAs in terms of learning dimensions, learning processes and possible transformative learning tenets. The interviews were recorded and those in local language translated to English and then transcribed by a research assistant.

Furthermore, observations were made during G1s' training facilitated by JAs on nursery tree establishment and management, 3 training sessions of G2s training G3s about PIP creation, trainings on landscape restoration, and sensitization workshops in 3 villages, aimed at scaling out the PIP project to subsequent generations. The observations supplemented data from interviews on how farmers were learning through PIP. Notes were taken during the observations.

3.3. Data analysis

Thematic analysis (Peel, 2020) was used to analyse the data, guided by the TLE pillars elaborated in the conceptual framework. This analysis focused on scrutinizing the text from the data set, which was organized in a word file, in order to identify codes. These codes were further organized into an excel file. Connected codes were combined into themes describing the possible *learning dimensions, learning processes*, and *transformative learning tenets* addressed through the PIP approach. Furthermore, the codes and themes were refined through an iterative process engaging the first author and the co-authors in multiple meetings leading to consensus on codes and themes.

Based on data analysis, the most illustrative quotes and observations were presented in this paper. Illustrious quotes were premised on criteria of: how well a particular farmer articulated and spoke to events within the learning processes, how a farmer represented views of many other farmers, and what unique things a farmer revealed about the learning processes.

4. Results

The analysis mapped the PIP transformative learning ecology in the Manafwa watershed as illustrated in Figure 4.

4.1. Learning dimensions

PIP farmers were exposed to multiple dimensions of learning focusing on: *learning to know* by supporting knowledge building, *learning to do* by supporting the development of action skills to foster change, and *learning to care* by supporting the development of attitudes to care for self, for others and for

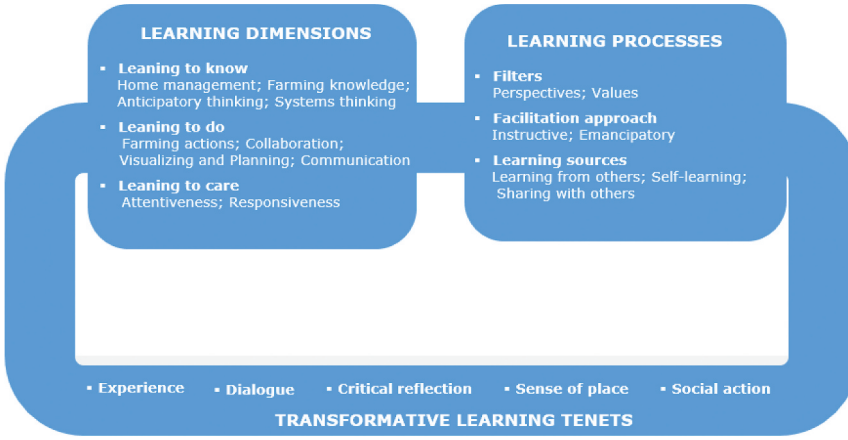

Figure 4. The PIP transformative learning ecology for socio-ecological stewardship.

one's environment. Each identified dimension of the *learning content* is elucidated in more detail.

4.1.1. Learning to know

In this study, *learning to know* included the acquisition of new knowledge and new ways of thinking that can lead to a better understanding in specific content domains. The knowledge, understanding, and ways of thinking fostered through PIP included: *home management*, *farming knowledge*, *anticipatory thinking*, *and systems thinking*.

Home management concerned aspects related to personal and domestic sanitation and hygiene, family income management, collective action at family level, and how these impact daily life. The *farming knowledge* included knowledge about agronomy, crop management and gardening, plant disease management, harvest handling, and principles of integration on the farm. A*nticipatory thinking* involved visioning, to reflect on future consequences of the individual, family and community actions on their life and on the watershed, and reflections on how to create a better future. These processes enabled learners to make connections across environmental, social and management aspects and hence building *systems thinkin*g. For example, during an interview, a G1 explained:

> In the past, we did not cultivate or build our houses next to the river, and the vegetation growing along the river could hold running water. Now, we do cultivate and build next to the river. When it rains, running water goes with our fertile soil into the river, the river is dirty and we are often sick. (G1_15)

Although all the three farmer generations were taught those content topics, the first-generation PIP farmers trained by the JAs, the G1s, were exposed to more *farming knowledge* compared to the other generations. Unlike other generations, G1s received additional training in agronomy, for example, about tree nursery establishment and management. The project deliberately provided needs-based training to G1s to build their capacities to train other farmer generations, during and beyond the project lifespan, and enabled them to implement their action plans better than other farmer generations.

4.1.2. Learning to do

Learning to do refers to contemplating and trying out actions. The skills taught through PIP incorporated: *farming actions*, *collaboration* skills, *visualising and planning*, and *communication* skills.

Farming actions focused on how to practice integration on the farm. Such skills included integration of livestock and crops, and learning to make decisions on combinations of practices that provide higher ecological and welfare benefits to households. Farming skills included soil erosion control, making trenches, pruning, line planting and mulching aimed at not only enhancing productivity but also conserving the environment for sustainability. *Collaboration* skills were aimed to enhance working together as a family and engaging in collective actions that benefit the community. During PIP trainings, it was observed that the JAs guided G1s and other community members to jointly create an integrated farm plan for each village based on shared aspirations. The skill of *visualising and planning* involved getting the farmers to learn how to assess their own situation using the SWOT analysis tool and to creatively consider new strategies for improvement through the PIP co-creation process. C*ommunication* skills focused on self-expression, reporting, listening and learning from others, and sharing relevant messages about the watershed. One of the second-generation farmers states what many others seem to say as well: "We were taught not to be harsh to others, instead, first greet, appreciate their work, and tell them what they need to do differently but don't force them to change" (G2_01).

All three farmer generations were taught to collectively implement the mentioned actions and skills. However, especially with regard to *communication skills*, it was observed that some G2 and G3 farmers were yet to develop the confidence to freely express themselves, and were more hesitant to practice the aforementioned skills compared to G1s. This could be because G1s were continuously supported by Junior Agronomists (JAs) to deepen their knowledge and build their confidence.

4.1.3. Learning to care

Learning to care refers to learning to become more sensitive, attentive and responsive to fellow humans, other species, materials and practices and places. Attitudes of care facilitated through the PIP approach were captured under topics of: *attentiveness* and *responsiveness*.

Attentiveness was fostered by enhancing farmers' consciousness and awareness about one's own situation and actions in relation to self and in as far as their actions affect others and the watershed. By cultivating alertness to one's own actions, farmers became more conscious about the impact of their actions on their wellbeing and their surroundings, as well as about how their surroundings impacted them. For example, it was noted during a sensitisation workshop that farmers were taught their interdependence with the watershed and how its quality could affect their wellbeing. *Responsiveness* centred around developing strategies to address individual and group challenges. At the individual level, *responsiveness* focused on taking responsibility to explore and experiment with new ways of doing things, being exemplary, and being prompt in developing new relationships of care with the watershed and with peers. At the group level, farmers were taught to share knowledge and experiences with peers in order to inspire each other towards taking collective action for restoring their watershed. To demonstrate awareness of their actions and bearing responsibility to take action, a G2 said, "I now know that the river is very useful to us and to our farms but we have spoilt it and we are responsible for restoring it" (G2_04).

All three farmer generations were taught to be attentive and responsive, both as individuals and as a community, to their own needs, the needs of others and their watershed. Consequently, all these farmers expressed attentiveness and responsiveness in different ways.

4.2. Learning processes

The PIP learning processes comprised: the predispositions of the farmers *(filters)* influencing the learning environment and the process of learning; the pedagogical approach adopted to support learning processes (*facilitation approach*); and the different sources of inspiration and learning (*sources of learning*). Each identified feature of the *learning process* is elucidated in more detail:

4.2.1. Filters

The *filters* were represented by the farmers' *perspectives* and *values*, which contributed to shaping the PIP learning environment.

The *perspectives* were shaped by the underlying rationale for which farmers were participating in the PIP program. These *perspectives* could sometimes evolve and transform throughout the training. Those *perspectives*

included: an *economic perspective* marked by their expressed need to increase household income; *an environmental perspective* evidenced by their aspiration to learn to take care of the watershed; a *sustenance perspective* marked by their need to be food secure in the long term. Many farmers demonstrated a transformation in perspectives, most remarkable of which was a G1_18 who said, "I joined PIP to increase food in my home but the more I went for the training, the more I also felt that I needed to engage with others to restore our watershed".

The notable underlying *values* of farmers included social values of sense of *respect* for the facilitator and the other farmers, manifested by listening to each other and treating each other fairly; a sense of *togetherness* at family and community level, expressed by supporting each other and willingness to work together; *spirituality* and strengthening religious faith, as it was observed that all PIP trainings were preceded by prayers; and *openness* towards the others and to the content learned, expressed by sharing own view or seeking views of others. To express his *values*, a G3 farmer proudly mentioned, "I feel good when I share with others what I learn. If I keep the knowledge I got from the training to myself, others will not know what to do" (G3_02).

All three farmer generations expressed those distinct *perspective*s. Making those *perspectives* explicit helped to guide the learning content throughout the farmer generations, for example farmers were taught how to increase the economic value of their crops in order to fetch more income. All farmer generations embodied the above mentioned *values*, except for the spirituality value, which was strongly manifested in one village compared to other villages albeit observed during trainings in all 3 villages. Expressing these *values* created a learning environment of mutual respect and working together through group tasks.

4.2.2. Facilitation approaches

A combination of *instructive* and *emancipatory* facilitation approaches were applied to aid farmer learning.

An *instructive* approach was demonstrated by teacher-centredness. The facilitator, either a JA or a farmer depending on the generation trained, was the expert. Learning content and learning processes were predetermined and transferred to the learners, for example the content regarding the PIP methodology. It was observed that learning materials were sometimes provided, the sitting arrangement had in some cases the facilitator in front of the class, and learners required the teacher's permission to express themselves. An *emancipatory approach* was marked by learner-centredness. Learner experiences were utilised for (peer-) learning. The farmers could determine and reconsider the direction of the learning, decide about some parts of the learning content, and were empowered to experiment with the insights gained

and take ownership of their learning process. For example, as put by a JA expressing his intent to empower farmers: "I have given you a fishing net. I cannot give you the fish. You have to fish yourself" (JA_02).

All farmer trainees were exposed to a blend of these two approaches: lessons were predetermined but participants could request for additional technical trainings based on their action plan implementation needs. Additionally, all farmers were exposed to an *emancipatory approach*, and had opportunities to observe each other's farms, to consult, to share and learn from (peer) experiences at their own pace.

4.2.3. Learning sources

Three source were identified to support learning within the PIP approach: *learning from others, self-learning, and sharing with others.*

Learning from others occurred through group-based activities and from the trainers. Peer learning occurred through assigned or voluntary group activities where learners chose tasks, shared opinions and made group presentations. Trainers used an instructive approach to guide learners or facilitated participatory peer learning and sometimes demonstrated within their farms and thus inspired learners to observe and sometimes replicate their actions. Other peer learning avenues included the joint training of trainers, for example G2s training G3s with a dual purpose of (1) ensuring that a coherent message about action planning is passed on and, (2) getting G2s to support each other during trainings at a neutral venue. *Self-learning* embraced all learning that was done by oneself through experiencing. For example, farmers said that they visited the watershed and consciously observed changes and, in other ways, learned by practicing and experiencing. *Sharing with others* related to farmer-to-farmer (peer-) learning within and across farmer generations. Learners individually learnt with or from peers by consulting them, listening to them, and observing activities on their farms. Farmer-to-farmer learning was underpinned by inspirations from farming practices of peers, opportunities to verbalise their challenges, discuss and ask each other critical questions. As said by a G2_01, "I often share what I learn with my family, neighbours and other community members".

The above three avenues were utilised within the PIP approach as platforms for knowledge flow and exchange across farmer generations. Observations illuminated the frequent use of arts-based methods such as the use of music, dance, poetry and drama as vital learning sources. Farmers used art during awareness raising and trainings to relay stewardship and restoration messages to peers. Thus each farmer had an opportunity for *self-learning* by experiencing through observing and practicing. *Self-learning* was strengthened by *learning from* and *sharing with others.*

4.3. PIP transformative learning tenets

Various transformative learning tenets were embedded in the PIP approach. These tenets included: *experience, dialogue and critical reflection* (Mezirow, 2009; Taylor, 2008), *sense of place* (Bainbridge & Del Negro, 2020; Gruenewald, 2003), *and social action* (Diduck et al., 2012; Moyer et al., 2016).

4.3.1. Experience

Experience related to space within the PIP approach for harnessing farmers' learning from their own actions. This tenet was manifested in multiple ways to encourage transformation. Across the dimensions of *learning to know*, *learning to do* and *learning to care*, the facilitator was often observed asking learners to share their experiential knowledge about a given topic, encouraging them to experiment with alternative ways of farming and caring for the watershed. Farmers were also encouraged to discuss watershed-related challenges and explore possible solutions to those challenges. This stimulated *learning from others* through experience sharing and group thinking. For example, a G2 said:

> One farmer told us about how he is improving the quality and size of his bananas to earn more. I realised I was doing it wrongly all along. I have started to experiment in my garden, with some of his practices. (G2_20)

In one joint training, some G3 farmers were observed expressing a dilemma in implementing some of the practices such as making trenches which they believed to occupy much space and to trigger landslides. Some other times facilitators were also adopting a more *instructive approach*, by directly adding new insights, based on the experiences shared, or introducing other ways of doing something.

Across the three farmer generations, the use of *experience* for learning and the subsequent reflection on *experience* was prevalent, but much more apparent amongst G2s and G3s since these were fewer participants per trainer, thus giving ample opportunity to each learner to share their experiences and learn from one another.

4.3.2. Critical reflection

The farmers did not just share *experiences* but were also facilitated to reflect on them. Critical reflection was fostered within the PIP approach by challenging farmers to critically think about the *perspectives* and *values* they put into action in their life and throughout the training, and to reflect on their knowledge, ways of doing and caring for the watershed (*learning to know*, *to do* and *to care*) and consider possible other ways of making sense of their challenges and operating in their context. Through visualising and planning farmers were taught PIP creation at household and village level. Through group

activities, they were probed to deeply think about their lives, their watershed, and their community (a system perspective) and thereby articulate their thoughts on paper (current situation). They were further asked to critically reflect on the future they want (desired situation) and illustrate it on paper. This was followed by an action planning process for them to develop strategies for achieving their desired future. An example of a facilitator probing critical reflection came from a G1 who said:

> The facilitator asked me to look at my current situation and how I would like my home to look like in the future. When I started to make my vision map, I discovered knowledge I did not know I had. My mind had been asleep, I started to work smart to improve my life. (G1_17)

By steering *systems thinking* and *attentiveness*, farmers reflected on how their actions affected others. For example, a G1_15 said, "thinking about my actions, I realized I was one of those who spoil the river and many people down there drink dirty water".

Critical reflection was fostered across all farmer generations, especially, during contextual awareness raising and PIP creation. *Instructively*, every farmer was mandated to reflect on and map their current and desired situation, and accordingly develop an action plan. It was noted that all farmer generations were insG1red by the mapG1ng and action planning process. Besides, some G2 and G3 farmers expressed lack of basic writing and drawing skills to draw maps and make action plans.

4.3.3. Dialogue

Dialogue comprised opportunities to raise ideas, share concerns, exchange perspectives and negotiate meanings. Through group activities, farmers held conversations in small groups, and in plenary. Farmers were tasked to prepare, in groups, a stewardship message using arts-based methods and so they engaged in sharing ideas, consulting each other and expanding their ways of thinking by considering ideas of others, until when they agreed on what and how to present. This supported processes of *learning from others* and *sharing with others*. To exemplify dialogue in learning groups, a G1_11 said, "we discussed the challenges and opportunities of making and implementing our action plans. I learnt how to plan and started to think deeply about sources of resources and the support that I needed to implement my plan". During a training of G3 farmers by G2 farmers in Munyende, farmers were observed to raise divergent views regarding the role allocation for implementation of the action plan. They discussed until they reached a consensus. Notably, these farmers further discussed *farming actions* like how to practice integration which included diversification of crop grown, animal rearing and diversifying income activities on the farm.

Observations of trainings indicated that dialogue was more prevalent during joint trainings organised for G2s and G3s as they discussed possibilities of implementing their action plans. However, some G3 farmers did not actively participate in dialogic interactions, others dominated the process while others felt bad that their ideas were not considered. Further, it was observed that some conflicts around divergent ideas arose and a lot of time was taken to generate consensus around these ideas.

4.3.4. Sense of place

Within the PIP approach, *sense of place* was encouraged by activities that fostered connection to nature and the watershed and recognition of interdependencies between people and the place they inhabit. Through the dimensions of *learning to know* and *learning to care*, farmers were facilitated to realize the importance of the watershed as well as its current degraded state. *Attentiveness* towards the watershed quality was facilitated during awareness raising sessions in which farmers also reflected on their *values* and *perspectives*. Through place-based learning, farm-based demonstrations were emphasized, farmers went to the watershed or were taken by JAs to observe some key features, connect with it, and deepen their learning. Besides, farmers also learned about farming practices through demonstrations. They were facilitated to develop strategies for *responsiveness* to their context. During an interview for example, a G3 mentioned:

> During the training, I thought about how the river had changed overtime. I sat and watched as it flowed. I saw the dirty flow, and our fertile soils running with it, as the water had nothing to hold on. I am now making trenches and planting trees in my garden, but we must work together. (G3_25)

Although *sense of place* was steered across generations, more learning visits were made to the watershed by G1s than other generations. However, over half of the G2 and G3 farmers claimed to have gone to the river by themselves, as part of their daily routine, where they unintentionally observed the watershed quality through *self-learning*.

4.3.5. Social action

Social action comprised possibilities for taking collective actions to address a common challenge. Within the PIP approach, farmers were taught *collaborative* and *communication skills*, aimed at nurturing their collective capacities for transformation. Through group work farmers learnt to support each other at family level and in the community. Using cell phones and other physical means, farmers consulted, mobilised and supported each other. Sharing of information and experiences were

mainstreamed in the trainings as day-to-day practice. On social action, a G1_15 expressed:

> We are taught to work together with fellow farmers and our leaders to improve the condition of our watershed. For example, most of us have started to plant trees in our farms along the slopes, using seedlings from our indigenous tree nursery as G1s.

Across the farmer generations, social action was strongly inspired by contextual awareness as farmers challenged themselves individually and collectively about their contribution to the status quo of and their responsibility to take action to restore the watershed in order to support achievement of their aspirations. The need for social action was emphasised in different ways given that one of the guiding PIP principles is collaboration. However, a G3_23 indicated that some farmers were not engaging into collective actions to restore the river despite the training.

5. Discussion

In this paper, we aimed to investigate features of the PIP approach that support transformative learning for socio-ecological stewardship in a specific rural context. In this section, we discuss key emerging aspects from the study findings that revolve around the mapped PIP Transformative Learning Ecology (TLE): the nexus between knowing-caring-doing; the PIP approach as a facilitated social learning process, and learning to transform in a socio-ecological context.

5.1. The nexus between knowing-caring-doing

Three core learning dimensions within the PIP approach were identified, centred around knowledge building (knowing), action skills to foster change (doing) and nurturing attitudes to care for self, for others and for one's context (caring). These dimensions which are mutually inclusive constitute integral parts of the Transformative Learning Ecology (Wals, 2020) and are considered in literature as a foundation for supporting stewardship (Bennett et al., 2018; Kevany, 2007). For example, knowledge building and action skills relate to information and know-how that characterises stewardship actions while care emerges out of a sense of responsibility for something or someone (Enqvist et al., 2018). The PIP approach shows that it is feasible and desirable to embed these dimensions when fostering learning for socio-ecological stewardship.

Knowing involves gaining knowledge about socio-ecological issues within one's context and therefore requires one's understanding of the world around him/her, being open to knowledge, and practicing absorbed

knowledge. The practice of absorbed knowledge (doing) thus depends on the knowledge one has (Lalbiakdiki & Lalrinzuali, 2018). Considerable social learning, which facilitates acquisition of local knowledge, occurs through observing, managing, and coping with uncertainties, or by reading or hearing about experiences of others (Folke et al., 2009). Local knowledge is significant as it provides awareness about the local context and guides an effective implementation of potential new actions (ibid) for stewardship. As further argued by Folke et al. (2009), local knowledge incorporates peoples' sense of place reflecting how people respond to the socio-ecological system and therefore how they are likely to engage in new approaches to ecosystem stewardship (ibid). The ability to engage in the new approaches and stewardship actions (doing) depends on their agency – their skills as individuals, organisations and collaborative networks (Enqvist et al., 2018). These skills may include ability to communicate effectively, build meaningful interpersonal relations, and the competence in transforming knowledge into innovations (Lalbiakdiki & Lalrinzuali, 2018). The PIP ecology supports the knowing-doing nexus by nurturing such type of skills.

Care is a relational and normative aspect of the TLE as it involves individual preferences and value judgements (Enqvist et al., 2018), thereby capturing aspects considered to influence stewardship action, for example, the desire to look after something based on the values, meanings, preferences, sense of attachment or sense of responsibility of the potential caretaker (West et al., 2018). The desire to care also depends on the ability to see and make connections between, for example, humans with humans, and humans with nature (Wals, 2020). As such, the notion of care represents the rationalised ethics intended to guide action and the tacit motivations for particular kinds of behaviour (Enqvist et al., 2018). The PIP ecology expands the nexus knowing-doing by including a caring component, as just delineated.

Although the nexus knowing-caring-doing is crucial for responding to socio-ecological challenges, there is not much documented evidence regarding how these dimensions, especially learning to care, are implemented for stewardship (Bennett et al., 2018). For example, care is identified as a vital dimension of stewardship, yet is the most understudied (West et al., 2018). Arguably, the limited exploration of the care dimension within research has also presented inadequate theoretical ground for facilitating the process of learning to care.

The impact of the knowing-caring-doing nexus on the stewardship outcome (Enqvist et al., 2018) also depends on the context within which the stakeholders operate. As such, learning to address an ecological challenge and, for example, the socio-economic context within which such learning occurs are indivisible and mutually affect each other (Jackson & Barnett,

2020). The learning content within the PIP approach integrates learning about ecological issues, such as watershed stewardship, with socio-economic issues such as building capacities to mitigate poverty and improve social relationships as a flywheel towards fostering stewardship among farmers. The integration of socio-ecological issues into social economic aspects as part of the learning process thus becomes relevant and could most likely lead to sustainable socio-ecological stewardship outcomes.

5.2. The PIP ecology as a facilitated social learning process

The socio-ecological stewardship stance that this study focused on is premised on the assumption that resilience relies on social interdependencies organised within a network of interactions (Mathevet, Bousquet, & Raymond, 2018). Moreover, stewardship is conceptualised as a collaborative effort that brings together multiple and diverse stakeholders, and therefore stewardship actions expected from social learning and collaborative processes include knowledge sharing and education, and participation research and monitoring (Cockburn et al., 2019). The PIP ecology features a supported learning process across all of its facets. This study illuminated multiple *learning sources* which also act as sources of support and mentorship, whereby farmers learn from each other (farmer-to-farmer learning) within and across generations, from project staff (the JAs), and from their leaders, through *collaboration*, dialoguing and shared *experiences*. Farmers also learn from themselves by practising and through experience. The support reflects in the *togetherness* value they embody through their recognition and willingness to work as a collective towards their improvement and that of their community. Moreover, as posited by Duveskog (2013), an important aspect of personal empowerment is the level of involvement in collective action and society involvement. The joint and individual learning process is vital for counteracting destructive systems and routines which pose as potential barriers for achieving strong sustainability outcomes such as socio-ecological stewardship (Chaves & Wals, 2018; Moyer et al., 2016).

The use of diverse learning methods can underpin multiple *learning sources*, peer learning and learner connection to the watershed – the place (Bainbridge & Del Negro, 2020). Learning processes within PIP indicated a blended learning ecology that combines *instructive* and *emancipatory* pedagogies that were well positioned to address the different values and perspectives that farmers brought to the learning process. The *instructive* pedagogy was important in introducing the PIP creation process which farmers were not familiar with while the *emancipatory* approach reinforced active learner participation, experience sharing and openness about learning aims. Although the agricultural extension education system in Uganda has been predominantly *instructive* (Friis-Hansen et al., 2014), this study demonstrated

the possible contribution of the *emancipatory* pedagogy in complementing a more *instructive* approach to learning as this contributes to knowledge co-production and social learning (Karubanga et al., 2017).

The transformative learning process within the PIP approach fostered anthropocentric values such as a sense of *attentiveness* and *responsiveness* towards environmental phenomena within their context and beyond. Anthropocentric values can underpin motivation for stewardship action as they emphasize the interdependencies between humanity and nature (Folke et al., 2016). These values also foster collective action, peer support and learning which in turn support stewardship (Cockburn et al., 2018). Yet, more attention could be given to fostering eco-centric values since socio-ecological stewardship emphasizes notion of humans and non-human species living together in a wider community (Mathevet, Bousquet, Larrère, et al., 2018). This necessitates that values like respect for nature's inherent worth, mutuality with other species, and taking the responsibility for conservation could be more emphasized within the PIP ecology.

Three farmer generations (G1s, G2s, and G3s) engaged in learning for socio-ecological stewardship within the PIP approach. They learned from peers within and across generations, from project staff and from their leaders through *dialogue*, *experiences* sharing and collective *social action*. These learning avenues illuminated a burgeoning trend of peer learning characterised by information sharing, farmer-to-farmer consultation, mentorship and collective navigation of challenges and solutions across farmer generations, which underpinned social learning for socio-ecological stewardship. Learning as a group and meeting frequently can contribute to development of common values and objectives which are vital for addressing wicked socio-ecological challenges (van den Berg et al., 2020). Moreover learners tend to consider farming advice as credible after crosschecking with peers and by the success of such advice from peers (Fieldsend et al., 2021).

There were some notable differences across farmer generations. G1s were provided with more (technical) knowledge and opportunities to request for training based on their needs. This boosted their confidence and positioned them for implementing their action plans compared to other generations, while other generations engaged more in hands-on activities and in forms of *learning to do*. Yet the additional training and other incentives given to G1s created a tension between G1s and other farmer generations, which somewhat affected collective *social action*.

5.3. Learning to transform within a socio-ecological context

Transformative learning (TL) is learning that reconceptualises the system through processes of reflection and engagement (Folke et al., 2009, p. 105). TL emphasizes learning as a mechanism for transformation (Diduck et al.,

2012), supporting the reconsideration of ways of thinking, being and doing (Folke et al., 2009). Learning to transform starts by learning to transform one's thought process and world views so as to change oneself and the surrounding. Facilitators of transformative learning processes therefore need to harness, appreciate and sometimes confront these *filters* (values, frames and perspectives) which form an integral part of a transformative learning ecology (Wals, 2020). Through the implementation of TL tenets, we can infer a transformative endeavour within the PIP approach. This endeavour focuses on facilitating a learning approach through which participants can revise ways of framing that they have hitherto taken for granted (Boström et al., 2018). For example, some farmers who joined PIP trainings with the aim to raise their income, later became more concerned about the health of the watershed and more aware about their role in protecting their environment, thereby enlarging their initial narrow focus on income. This study thus points to the fluidity of learning aims and suggests that the PIP ecology can support learners to change or adjust their learning aims. This mindset change is crucial for dealing with socio-ecological challenges which require disentangling construed meanings to allow for alternative ones that are more generative in creating sustainable pathways (Wals, 2020). To disentangle such mindsets, Mezirow (1991) posits that learners need to be exposed to multiple and alternative ways of seeing, framing and interpreting phenomena. This exposure leads to dissonance which acts as a tipping point in one's thinking, aids reframing and thus invites new perspectives (Wals, 2020).

As part of learning to make change in their context, PIP farmers learn together to solve their watershed challenges departing from theory to knowledge generation through *dialogue* and *experience* sharing. The *collaborative* and *communicative* aspect within the PIP ecology nurtured a sense of *responsiveness* towards *social action* for restoring the watershed. Such collective *social action* is vital when addressing socio-ecological challenges where stakeholders collectively apply what they have learned (Cockburn et al., 2018; Moyer et al., 2016).

Enhancing connectivity with the place underpin learners' appreciation of their environment (Bainbridge & Del Negro, 2020; Gruenewald, 2003), affirms cheerfulness, dignity, and freedom to engage in recurring tasks within the socio-ecological spaces they occupy (Mathevet, Bousquet, Larrère, et al., 2018). The place-based nature of learning within the PIP approach which was, for example, demonstrated by farmers learning from the watershed and from others' farms through observation, can facilitate establishing connection with the *place* (the watershed) and thereby derive the motivation to steward it (Bainbridge & Del Negro, 2020). As emphasized by Gruenewald, place-based pedagogies are required so that the learning process can have an impact on the social and ecological spaces that people inhibit.

6. Conclusion

The study analysed how farmers are learning for socio-ecological stewardship through the PIP approach within the Manafwa watershed. Based on interviews and observations (of trainings and sensitization workshops), the study reconstructed the transformative learning configuration of the PIP approach. Findings indicate that the PIP learning configuration a transformative learning ecology constituted by the interconnected *learning dimensions*, *learning processes* and *transformative learning tenets* that all together form an organic learning system across the three farmer generations, providing a foundation upon which they learn for socio-ecological stewardship in rural contexts. This was evidenced by observed *transformative learning tenets* which contributed to changing farmers' mindsets and enabled them to redefine their values, perspectives, routines and practices towards socio-ecological stewardship. The identified PIP TLE can be considered as a useful heuristic that both scholars and facilitators can use to analyse and to organize transformative learning processes aimed at addressing socio-ecological challenges.

Finally, as a limitation of this study, we recognize that the TLE configuration as described in this study emerged from a limited number of interviews and observations of the PIP trainings, in a specific study context. Also, at the time of data collection, the MWARES project was still ongoing and possible transformative outcomes of the trainings could not be captured in their entirety. Further, the article makes reference to only a limited number of direct quotes from participants which does not necessarily show differences or similarities in opinions of each of the participants. These limitations may have prevented the emergence of new insights and perspectives regarding the features of the PIP learning ecology. Thus, further research could focus on enlarging the data set through other research methods such as focus group discussions, on exploring the worthiness of the identified TLE in other contexts aspiring to foster socio-ecological stewardship, and on investigating the transformative outcomes of the TLE configuration for stewardship.

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ORCID

Doreen Misanya http://orcid.org/0000-0003-0657-4251
Valentina C. Tassone http://orcid.org/0000-0002-0828-2730
Aad Kessler http://orcid.org/0000-0002-0954-1896
Paul Kibwika http://orcid.org/0000-0001-6502-2487
Arjen E. J. Wals http://orcid.org/0000-0003-4735-1126

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